

CHEMICAL & METALLURGICAL ENGINEERING

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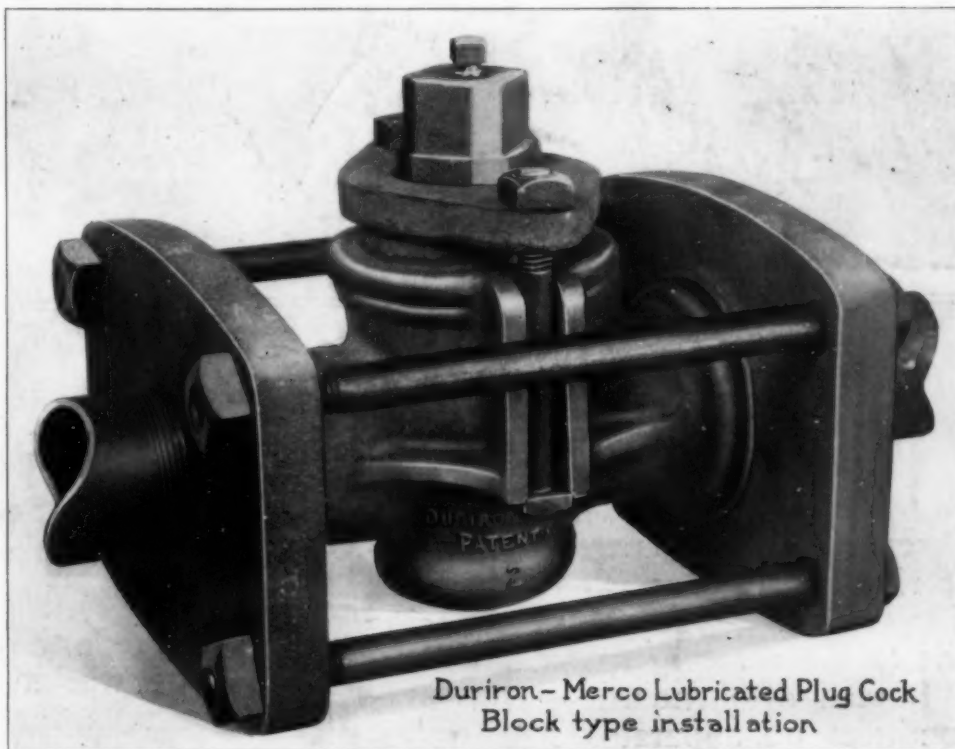
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Block type installation

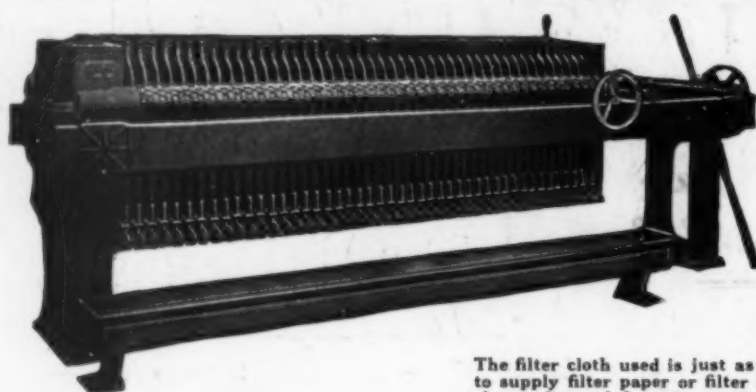
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CHEMICAL & METALLURGICAL ENGINEERING

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H. C. PARMELEE, Editor

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Number 5

The Law

And the Profits

IN ENGLAND last year, in a hearing before the Board of Trade, the question was argued before a referee whether or not calcium carbide might be included among the substances covered by the safeguarding of industries act. The referee was learned in the law, but was in no sense a chemist, so the argument became long and very much tangled up. He did not have even the aid of a chemist to shed light on the subject, consequently the hearing became a curious discussion in chemistry by lawyers. His conclusion was that calcium carbide is not a synthetic organic chemical, and is therefore not properly included under the act.

Sir WILLIAM J. POPE discusses the subject in *Chemistry and Industry* (vol. 42, No. 1) and declares the proceedings to have been "an orgy of misinterpretation and misapprehension." It was admitted that calcium carbide is a synthetic compound, but the expounder of the law shied at admitting it to be organic. Then Sir WILLIAM brings to bear his proofs that organic chemistry is the chemistry of carbon compounds, and he makes a good case of it. He quotes from KEKULÉ, LAURENT, VAN'T HOFF (who said that "organic chemistry has for its object not only the study of the compounds of carbon, but also that of the element itself"), H. E. ARMSTRONG, BEILSTEIN, and numerous other authorities. Next he takes up those who have endeavored to qualify the statement. Thus SCHORLEMMER called it "the chemistry of hydrocarbons and their derivatives," but Sir WILLIAM points out that while this would exclude carbon monoxide, it includes carbon dioxide as a derivative of methane, but again would exclude purine. FRANKLAND said that organic chemistry is restricted to compounds the molecules of which consist of two or more atoms of carbon, directly combined either with carbon, nitrogen or hydrogen. This excludes, for instance, perchlormethyl ether, $(\text{CCl}_3)_2\text{O}$, from the category. REMSEN says that, strictly speaking, the carbonates should be included in organic series, but that it is customary to treat these widely distributed substances under the head of inorganic chemistry. G. S. NEWTH in his textbook on inorganic chemistry says, "No exact definition of organic chemistry has ever been framed" and that it is "the chemistry of carbon compounds with certain generally acknowledged exceptions." He is wrong in his opening paragraph: All the carbon compounds is an exact definition, and the exceptions are not generally acknowledged. E. P. MOELLER is his "Law of Atomic Linking" (1895) declares that "in all organic compounds carbon and hydrogen appear as never failing constituents." Of course that is absurd.

The conclusion we reach is that it is better in con-

tracts and in law and in all writing that is likely to pass through the fire of juristochemistry, to say *carbon* rather than *organic* compounds. By juristochemistry we mean those chemical discussions and disputes that are carried on at court without a knowledge or understanding of the science.

Salesmen's Report

On the Chemical Exposition

FOR some months past a special committee of the Salesmen's Association of the American Chemical Industry has been investigating the Chemical Exposition with a view to proposing constructive measures for improving the usefulness of that annual affair. The final report of the committee is recorded in our news columns.

From a reasonably intimate familiarity with the Chemical Exposition we have read the report carefully to see what elements of novelty it contains. It is a constructive document and shows a commendable desire on the part of the Salesmen's Association to obtain for the exposition the hearty support of the chemical industry *per se*. It proposes also to insure an appropriate attendance by holding during exposition week a congress of chemical and consuming industries as represented by various technical and trade organizations. It suggests a fund to be created out of a part of the Exposition Company's receipts to be expended on educational exhibits of the chemical industries; and finally it recommends representation for the executives and sales departments of the industry on the advisory committee of the exposition.

It is not in derogation of the salesmen's efforts to say that all of these proposals are not new; but at least they are brought together at one time as the expression of opinion of an important organization. All of them will be susceptible of easy execution with the exception of the proposed congress, which will require the best efforts of the Salesmen's Association to induce a large number and variety of technical and trade associations to forego their customary meetings and join in a common plan for the promotion of the chemical industry. It is not impossible, but it will not be easy to accomplish.

Two points of interest about which considerable controversy has been waged—namely, annual or biennial expositions, co-operative or private shows—have been settled for the moment. The annual show is regarded as essential for the time being, and the co-operative show is dismissed as undesirable if private management will heed the desires of those who make the show possible. It would now seem as though we can look forward without distraction to a satisfactory Chemical Exposition in 1923.

Fuel Supply a Factor In Industrial Development

NATURE has provided one of the most convenient forms of fuel in the natural gas resources of the country. These resources have been developed on a tremendous scale largely for public utility gas supply. During recent years, however, there have been numerous discoveries of natural gas so located that it cannot be utilized economically for city supply. The question has therefore been raised how best to apply this splendid resource to industrial purposes. In the state of Texas there have been a number of such problems confronting property owners and public officials. Referring to one of these cases, a state official said: "It has been our purpose and effort to bring these fields into contact with enterprises which would convert this gas to commercial uses not wasteful. And I believe that the fields present today an inviting opportunity to capital."

The case to which this official made reference is but one of a number where large supplies at points some distance from great municipal centers offer immediate prospect of cheap, adequate fuel supply. No group of industries is better suited to use this resource than the chemical and metallurgical industries. The time is past when resources of this sort are going to be used extensively for the crude operations of brick-making, boiler firing and other heating work that can be done equally well by coal. In general state officials frown upon that type of natural gas utilization; in fact it is forbidden in some states. But many fine industrial heating operations that require close control of temperature can use gas supplies such as these to great advantage; and it is well recognized that the efficient burning of this gas for heating operations of high order can properly be encouraged by the public official.

It will be well if industries having heating problems of this sort will investigate some of the Texas, Wyoming and other Western gas occurrences for which there are no other close-by markets. There should be a basis of mutual service to the local communities and to those industries through their development.

The Outlook for Better Trade Statistics

ONE of the notable accomplishments of the Department of Commerce since it has been under HERBERT HOOVER's direction has been a marked improvement in the character and scope of the governmental statistical services. With the inauguration of the *Survey of Current Business* timely figures on production, stocks and prices were made available to industry. Progress in the case of foreign trade statistics, however, has been somewhat less pronounced, but recently some changes have been made which promise greatly to facilitate the compilation and dissemination of import and export figures. In the first place, new schedules have been worked out which show imported commodities in much greater detail and at the same time so arranged as to give figures which are easily compared with production and export data. Production plus imports minus exports has long been a favorite formula for the statistician who wishes to approximate the total consumption of a commodity.

The revised import schedules went into effect with the enactment of the new tariff, Sept. 22, 1922. New export schedules have been in use for several months

and certain improvements have already become evident. Quantity figures are now obtained for many commodities for which only values were previously available. This greatly increases the accuracy of these statistics, for in the past, as has been pointed out by the manager of the foreign commerce department of the Chamber of Commerce of the United States, export declarations have often been carelessly made at purely fictitious values. Thus copper wire had been billed at 4 cents a pound, white lead at 2 cents a pound, and so on. Obviously export values thus obtained are practically worthless in sizing up an export market.

Furthermore our statistical service has been considerably strengthened by the recent action of Congress in authorizing the transfer of all statistical work on imports and exports from the customs service of the Treasury Department to the Bureau of Foreign and Domestic Commerce. With the new schedules in operation, with the government's statistical machinery working more efficiently and with both importer and exporter co-operating to make their declarations as accurate as possible, 1923 should mark a new era in a sort of service that can be made a most effective agent in the promotion of our foreign trade.

Intelligent Use Of Intelligence Tests

THERE are at least two general types of intelligence tests. One is an information test that seeks to ascertain the breadth and accuracy of an individual's knowledge. The other is a test that evaluates his mental agility, quickness of decision and accuracy of judgment. All intelligence tests seem to have played in hard luck. The prominent experimenters were often inept and dogmatic and their conclusions have pyramided until we have been given such monstrous statements as "the average adult intelligence in America is that of a 12-year-old boy." WALTER LIPMAN has pointed out how silly this is. The average intelligence must by definition be that of the average adult. Whence then the startling conclusion? A pre-war experimenter had carried out a series of tests on less than a hundred Californians. He assumed that the average rating obtained was equivalent to adult intelligence, or 16 years, and he extrapolated back to the theoretical value which should be obtained by persons of 14 and 12. Then came the remarkable army tests, over 2,000,000 of them. The California experimenter tried to translate these results into the California rating, a procedure both hazardous and questionable, and arrived at the remarkable conclusion mentioned above.

At present the attitude toward intelligence tests oscillates between amusement and ridicule. This is unfortunate, for we are neglecting a most useful tool. A recent folder from the Engineering Foundation tells an interesting story of the use of intelligence tests. It seems that the salesmen in a certain organization were all given an intelligence test and strangely enough the relation between high intelligence and sales return was apparently nil. This was a facer until it was discovered that the salesmen were not well paid and those who stayed with the company long enough to develop good records were stolid men contented with the low pay and slight advancement. This led to the use of the test in such a way as to eliminate as candidates for the job of salesmen, first, those who were of such inferior mentality that they could not reach the lower critical

score, and second, those who obtained a mark above a certain other critical score, since the latter would not long be satisfied with the low pay of the salesman in that organization.

The whole subject is in its infancy, so it is refreshing to hear of intelligent use of intelligence tests. We commend the idea to your attention as being promising of fruitful results in industry.

Promoting a Policy of Interchange of Information

IT IS significant of a nascent era in chemical industry that such studies as those of C. C. VAN NUYS on rectification are fostered and encouraged and then made available for chemical engineers. Within the scientific memories of most of us distillation and rectification were essentially empirical, practically solved problems. Experience told how many trays to use and how large the column should be.

Mr. VAN NUYS has attacked the problem thermodynamically and his analysis of variables and limiting conditions has been more rigid and more complete than any yet published. The results and formulas given in his articles, the first of which appears in this issue, are the basis of production in plants of the Air Reduction Co. They have passed the pragmatic test: they work. Purer products and higher yields at the same time have been an immediate result.

The significant facts are, first, the inception of this theoretical research and its distinct success; and second, the publishing of the theoretical basis upon which the results are built. Such things cannot help but produce an optimistic feeling and strengthen the belief that perhaps chemistry will yet pass through that beneficent revolution which has made American metallurgy the most progressive industry in the world—a revolution that will foster and encourage a free exchange of ideas.

An Outside View of Our Tariff Problems

OCCASIONALLY the chemical industry is accused of inbreeding. The criticism is made that we have isolated ourselves from the general public and have been satisfied to look out on the great economic problems of the nation from the very narrow, if not selfish, viewpoint of our industry or profession. Without debating the justification of such a criticism, we believe it is nevertheless worth while to take note of the prevalence of this view. It is for this reason that we wish to call the industry's attention to a rather unusual article on the tariff by Prof. F. W. TAUSSIG, which appeared in a recent number of the *Quarterly Journal of Economics*. Its author has long been recognized, at least among economists, as an outstanding authority on the tariff, although his well-known views along the lines of free trade and low duties have never won for him a large following among the protectionists. His present article, however, is of the nature of a historical account of the economic and industrial developments leading up to the enactment of the new tariff. Excerpts from it having particular bearing on the chemical industry have been reprinted on page 210 of this issue.

It is our belief that in this discussion of the "purely economic aspects of the case" our readers will find a rather novel line of thought. The comparison of the

German and American industrial ways and aptitudes and the conclusions as far as the dye industry is concerned would seem to be fundamentally sound. On the other hand, we can scarcely be expected to add our approval to the author's apparent disposition to subordinate the "war argument"—i.e., the chemical industry's relation to the national defense—in favor of such an idealistic consideration as the economist's theory of the international division of labor. As far as we are concerned, stern realities have already answered "the old question of whether it is worth while to restrict the advantages of the international division of labor because of a possibility of sudden disruption."

The question of rates and the application of the American valuation plan bring up still other controversial issues on which we have already made our stand. Suffice it here to say that the effectiveness of these provisions will turn largely on their administration and that time alone will tell whether or not "the new rates of duty are extremely high" or the American valuation plan is a workable administrative procedure.

Coal and Chemical Engineering

ANNUALLY the American miner takes from the ground a larger tonnage of coal than of any other single mineral product; yet in general the utilization of this material has followed the happy-go-lucky, spend-thrift American method of "easy come, easy go." Lately, however, with increasing cost of coal production and with increasing irregularity in coal markets, even the coal-mine operator is beginning to see that there is a real engineering problem in the utilization of our fuel resources. A representative of one of the large coal companies recently expressed himself thus: "We feel that the time has come when a distinct advance should be made in the marketing of our product and look to gasification as a solution of at least part of our problem."

Somewhat the same point was stressed by the official representative of the American Gas Association when he appeared before the Federal Coal Commission. He emphasized the fact that the gas industry is a branch of chemical engineering requiring particular kinds of coal for processes which are not haphazard but based upon the latest and best of science and technology.

These are but two of the recent evidences that coal is recognized as an important raw material for American industry. And gasification of the coal before use as a fuel is a logical step forward in the application of these ideas.

A great deal of research on coal processing has already been done, but we need much more. We need particularly to learn how to get daily the maximum output in millions of heat units per dollar of investment cost. The problems of quality of product and regularity of operation have been largely solved by the makers of water-gas machinery, by coke-oven builders and by the contributions of skilled operating men in all classes of gas works. Yet today we find that one of the principal items in cost of gas, whether for city supply or for industrial use, is that of capital charges. There is still much to be done by the chemical engineer in devising more productive and efficient schemes in order that this part of the problem may not remain as serious a one as it now is.

Readers' Views and Comments

"Chem. & Met." as a Text Book

To the Editor of Chemical & Metallurgical Engineering

SIR:—I have a new use for *Chem. & Met.* which is working out pretty well in practice, and that is as a text book. I have a class in industrial and organic chemistry composed of young fellows who work all day in the industry and then come to school five nights a week. They really do come, too; not only is attendance required, but they are interested. Furthermore, each knows more than I do about some one or two things, and it is my job, in part, to even up their general knowledge of chemistry.

There is no one book I can ask them to get which is within the price limit and not too advanced, so I have arranged for them to each take *Chem. & Met.* and every week we go over it. Sometimes articles are assigned, sometimes we take a chance, and, pretty regularly, the price lists are used as a sort of old-fashioned spelling bee, the fellows telling whence things come, how they are made and what they are used for. They are also expected to be able to answer questions on the advertising pages along the same lines. Of course the regular lectures, coming before and after this session with the paper, may or may not hit something in that particular issue, but very often they do, or at any rate some matter which has recently had some notice in the patent lists.

As the year goes on and we get a larger background there is an increasing number of articles which bear on what I have been telling them, and my hope is to have every student able to tell something about all the common chemicals and to read most of the articles with intelligent interest by the time we have finished our course. It seems to be working out that way; at any rate they are coming to see the length, breadth and depth of the knowledge of chemistry, and how each of them fits in.

Newark Technical School,
Newark, N. J.

Steel at Moderate Temperature

To the Editor of Chemical & Metallurgical Engineering

SIR:—Several articles have recently been published in reference to physical tests on iron and steel at elevated temperatures. An article on "The Blue Brittleness and Aging of Iron" by Dr. Fettweis was published in *Stahl und Eisen* for Jan. 2 and Jan. 9, 1919, which I think is a most valuable contribution to the literature. Dr. Zay Jeffries is the only writer in this country who has made any reference to the work of Dr. Fettweis; at least no other reference has come to my notice. This leads me to believe that this important work has been very largely overlooked.

At the head of the article by Priester and Harder on "Effect of Temperature on the Mechanical and Microscopic Properties of Steel" (*Chem. & Met.*, Jan. 17, 1923, p. 111) this editorial summary appears: "Properties of a low-carbon steel in the blue heat range are inherent to that temperature and are not duplicated when same metal is tested at room temperature after a corresponding tempering." I do not believe this statement holds true. I believe the results can be duplicated

when tested at room temperature *provided the metal is cold-worked before or during the tempering.* Fettweis demonstrates this clearly.

That Priester and Harder did not get a higher value at 300 deg. than at room temperature (Fig. 3, p. 12) seems to be due to the "annealing" effect at this temperature overbalancing the "aging" effect, as they started with quenched samples.

At the September, 1922, meeting of the Electrochemical Society a paper was presented by Norman B. Pilling on "Effect of Heat-Treatment on the Hardness and Microstructure of Electrolytically Deposited Iron," and the increase in hardness at 300 deg. C. was ascribed to the decomposition of the iron-hydrogen compound. That the iron is deposited in a strained condition has been clearly demonstrated and I believe the increase in tensile strength at the blue brittle range is to be accounted for in the same way as that noted in iron strained by cold-working and then heated to the blue brittle range.

R. O. GRIFFIS,
Assistant Metallurgist,
American Rolling Mill Co.

Middletown, Ohio.

Numbering Steels

To the Editor of Chemical & Metallurgical Engineering

SIR:—The editorial pages of *Chem. & Met.* have been the source of so much instruction to me, and I have come to hold them in such high esteem, that I cannot forbear a few words of mild protest regarding the discourse on "Numbering Steels" appearing in your issue of Dec. 27. Having taken an interest in that subject for some time, I read your editorial with considerable eagerness, hoping for the usual clarifying exposition of a difficult topic. Forgive me, therefore, if I confess to a keen disappointment and a feeling that the matter was wound into an unintelligible tangle and dropped there.

You proceed to show that the SAE system, at first logical, has now become arbitrary, because of the constantly increasing complexity of steels offered, but you cite this arbitrary class numbering as an *advantage*, although arbitrary numbering was the very evil which the SAE system was originally designed to avoid! You next lament, Friend Editor, that "a logical code indicating the chemical composition of steels has so far eluded discovery" and observe how much more difficult it would be to devise a code which, in addition, will denote "that physical property" which is desired. Again, you assure us that information on the chemical composition is only incidental, since an ordnance constructor wants not chemical analysis, but a gun tube, with high transverse strength and ductility; and so on. We are then asked how all this is to be got into one code.

The answer, of course, is: It is not. Even if all the properties named were to be got into a code, somebody would come along with a lot more real or fancied properties that could not be coded. Moreover, if none of these gentlemen care about composition, as you intimate, why are modern steel specifications tending more and more to include chemical analysis?

The point of the whole discourse is finally disclosed to be that the only known way to describe a steel is in a detailed specification, and that it does not really matter in the least how the specification is designated. It is added that all of the steels might (for "practical" purposes?) be indistinguishable chemically, good steel being "more than low phosphorus and sulphur."

All of which leaves us just where we started, although a trifle dizzy.

Have the editors of *Chem. & Met.*—so often leaders of progressive thought in affairs technical—really nothing better to offer than persiflage on a subject which has called together a group of engineers, representing perhaps thirty national organizations on a series of conferences? Can you not give your readers some really constructive, helpful, logical and practical suggestions on this important and delicate subject?

Perhaps this code problem seems complex and difficult because we make it so. It is only when we try to "discover" a code system which will express in one neat and compact little symbol all we want to know about a steel, including diverse and sundry physical properties, method of manufacture, its physical state, heat-treatment, and even the purposes for which intended, with or without chemical analysis (all of which have at various times been suggested), that we get into a muddle and reject the idea as impracticable. Of course it is impracticable to expect one symbol to do all that work, for it would then be no longer a symbol, but merely a specification number, and we should have to refer to the specification to get our data.

However, what is really under consideration is "a numbering system for steels—not the *properties* of steels. That there is a real need for such a system has already been definitely agreed upon.

When the SAE founded its system, a dozen years ago, it made its symbols express the principal alloying components, carbon, nickel, chromium, etc., and did not try to make the same symbol tell all the physical characteristics which any steel might, under various treatments and circumstances, possess. It recognized the fact that one steel may be made to meet a wide variety of physical specifications by different treatments, and also that a given set of physical properties can be met by a considerable number of different steels appropriately treated. It stuck to chemical analysis for its symbols, and took care of the other properties by means of specifications. The system has been quite successful and very useful. Unfortunately, the SAE code, using numerals only, is not capable of unlimited expansion, and cannot be logically extended to take care of all the useful alloys which are developing. This is admitted. What is needed, therefore, is a truly elastic and comprehensive symbol system for steels, showing the principal components, which can take care of any useful steel now existing or which may exist in the future. Such a code cannot be "discovered," but can and will be developed by logical thought.

The answer seems to be found in an abbreviated chemical formula—that is, a code wherein the important elements are represented by letters corresponding to or suggesting their chemical symbol and the approximate quantities of these important elements are indicated by numerals. Here we have letters and numbers each acting in their true function—letters for names and numerals for amounts. The principles of such a code have already been outlined and shown to be quite practicable. (Universal Steel Code, Knerr & Collins, *Iron Age*, Sept.

1, 1921.) A code along very similar lines (although with some objectionable details) has recently been tentatively issued in Europe by the Standards Committee of the Swiss Association of Engine Builders.

Once having a truly elastic, comprehensive, brief, logical and easily learned and remembered symbol system for steels, we can proceed to indicate the physical characteristics desired in any given steel by a specification number, or by an appended symbol, if we so desire. Special chemical characteristics, such as high or low phosphorus and sulphur, etc., may also be indicated, where necessary, without confusion.

HORACE C. KNERR.

Naval Aircraft Factory,
Philadelphia, Pa.

Importance of Proper Technical Testimony in Patent Suits

To the Editor of *Chemical & Metallurgical Engineering*

SIR:—In your issue of Jan. 17 under the head of "Patent Notes" there are two pages devoted to a review of the decision of the N. Y. courts in the infringement suit of the Philadelphia Rubber Works Co. vs. the United States Rubber Reclaiming Co. claiming infringement of the Marks patent on the "alkali process" of rubber reclaiming.

It may not be generally known that the Ohio court's decision on the validity of these patents was quite at variance with the New York court's decisions.

The Philadelphia Rubber Co. sued the Portage Rubber Co. of Akron for infringement of the same patents and at about the same time. By expert testimony it was shown that a number of patents had been issued long before on the use of both alkali and acids with various heating methods for reclaiming rubber and that in the Mitchell patent it was claimed that it had been discovered that there was advantage in submitting rubber with reclaiming agents "either acid or alkaline" to heat under pressures comparable to that specified in the claimed process.

It was further shown by expert examination of the file wrapper and contents that the Patent Office had been misled by erroneous statements and affidavits in the case which claimed that all of the sulphur, both free and combined, was removed, thus producing a new product, while admissions of complainants at the trial proved that no combined sulphur was removed by the treatment of vulcanized rubber with 3 per cent caustic soda at 150 lb. steam pressure for 24 hours, which was the claimed process.

Further, it was shown the court that the object of reclaiming was, first, to remove fiber and that acid best removed cotton fiber; second, that the free sulphur should be removed and that this could be done at ordinary pressure by boiling in weak alkalis, a process commonly used to prevent "blooming," and third, that plasticizing was a function of heat and time and was not affected by the chemicals.

Defendants had modified their process so as to remove the fiber first with acid in open tanks and then this was, after removal of acid, treated with alkali at lower pressure and for shorter time than that specified by the patent and that necessary for devulcanizing by its use.

With these facts brought out by expert testimony, the District Court of Northern Ohio decided that the patent was invalid on account of fraud practiced on the Patent Office in claiming the removal of all the sulphur,

but a rehearing was granted because defendants had not alleged this as defense. On the rehearing the defence offered no chemical testimony and the judge decided from the evidence that, at the time of the patent application, there was no way known to determine whether combined sulphur was in the reclaimed rubber or not. Of course all chemists will see at once that the judge was misled on chemical facts. But he decided that the patent was invalid anyway on account of the anticipation by the cited Mitchell patent.

On appeal to the Circuit Court of Appeals of Ohio in Cincinnati, official cognizance was taken of the fact that in the meantime the New York courts had held the Marks patent valid and infringed, but the court decided that it was not necessary to decide this point, as it was convinced the technical testimony had made it plain that the defendant, Portage Rubber Co., was using a different process from that claimed by the patent in suit and that therefore there was no infringement.

Thus it is seen that in the original home of the "alkali" process the patent was twice declared invalid, while in another state the courts of equal standing on different testimony declared the patent valid and infringed. This shows the necessity of such technical testimony that the judges can perceive the actual chemical principles and practice involved in any patent brought before them. Usually they are ignorant of the chemistry involved, but understand logic and can comprehend any chemical proposition explained logically and lucidly to them.

H. O. CHUTE.

New York City.

Accelerated Reactions in Pulsating Gas Currents

To the Editor of Chemical & Metallurgical Engineering

SIR:—In reference to the article "Accelerated Reactions in Pulsating Gaseous Currents," I have no experience with the suggestion therein contained. I do know, however, that the problem of "channeling" is a very serious one in many catalytic gaseous reactions and anything that may be done to obviate the difficulties which so arise would be of very considerable importance in the technology of such processes. I believe that definite information concerning the advantage or otherwise of such pulsating currents might be very readily attained in the study of a well-chosen catalytic gaseous reaction taking place in contact with a solid contact agent. I think it should be possible to determine definitely what improvement might be effected by the pulsating process. And that, perhaps, more readily than in the case of absorption processes mainly discussed in the article.

Princeton University,
Princeton, N. J.

HUGH S. TAYLOR.

To the Editor of Chemical & Metallurgical Engineering

SIR:—I have reread the article on "Accelerated Reactions in Pulsating Gaseous Currents." It seems to me to be a very good article from a standpoint of getting one to consider the possible benefits from pulsating gaseous currents.

However, the question came into my mind two or three times, Does the increased efficiency, due to pulsating gaseous currents, compensate for the increased cost of producing them? Can this article be followed by one giving quantitative figures showing in one or two instances the increased capacity which the authors' claim? For example, they claim increased capacity in absorption towers with pulsating current and that gas producers operate more regularly and with greater out-

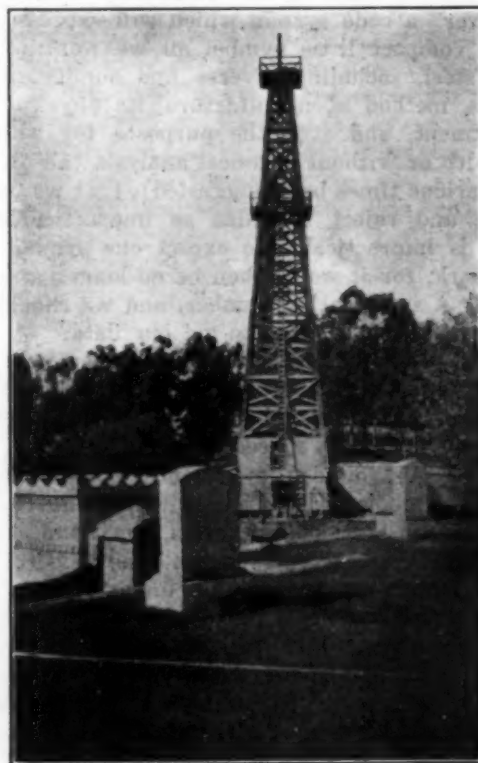
put when operating with a pulsating current or blast. Proving these points would be a very valuable thing and some data should be given to support their case.

Massachusetts Institute of Technology. R. T. HASLAM.
Cambridge, Mass.

An Oil Well in a Graveyard

To the Editor of Chemical & Metallurgical Engineering

SIR:—No doubt you will be surprised to observe the California postmark on this communication, so permit me to explain that the insufferable weather of the metropolitan district induced me to leave my office in charge of my son, Marcus, and set out on a jaunt to the Golden Gate. Yesterday, while on a little excursion to Long Beach, I chanced upon a sight so odd, and one which inspired such humility, that I snapped the photograph which you will find inclosed. An oil well in a graveyard! It is producing, too.



A PRODUCING OIL WELL IN A CEMETERY

I am sure you will understand the irresistible urge that came over me to philosophize on the brevity of this fleeting shadow and the cynical humor of the situation. Evidently, one need no longer be a Pharaoh to "make" the front page. And who shall say that the account of the discovery of Pharaoh's tomb, his mummified remains with his favorite pocket flask and a somewhat moldy but otherwise perfectly preserved paté de fois gras, his favorite dish, may soon be driven to a less prominent position by a column headed, "300 Barrels a Day of Paraffine Base Crude From Grave of John Doe."

I note that you propose an epitaph in an editorial of your issue of Jan. 3, "Here lies John Doe—Engineer." The spirit of your thought is indeed commendable, but fancy the dismay of John's shade, passing by 500 years later and reading, directly under the Requiescat in pace,—"S. O. Co. of N. Y. Keep off!" As a matter of fact, my guide assured me that no evidence has been found to indicate that the oil was derived from decaying hu-

man remains. But I must close, or you will be waiting my demise in order to stake out a "gusher."

A gruesome subject, Mr. Editor. I believe I will run down to Hollywood this afternoon. MARTIN SEYT.

Dirt in Steel

To the Editor of Chemical & Metallurgical Engineering

SIR:—In a recent issue appeared an editorial on the subject of "dirty steel." There are certain phases of this on which I should like to present another viewpoint. In reading this article there is a tendency in the reader's mind to find a direct condemnation of steel made in large quantities—"tonnage steel" it is termed.

That steel made in smaller quantities may perhaps appear better from a theoretical standpoint or from laboratory examination will not be questioned. There is, however, a decided difference of opinion as to the actual commercial value of such differences as may appear in favor of the smaller lot. When one considers the successful application of "tonnage steel" in tremendous quantity, particularly in the automotive industry, which was directly mentioned, one may hesitate to condemn offhand this material.

It is true that "dirty steel" has been found and that it has caused trouble, but it must be remembered that when such cases have been found they have received exceedingly wide advertising. It is not always remembered that such cases represent an extremely small proportion of the amount in service. Furthermore little mention is made of the large quantities which render excellent service.

In the writer's experience with steel, covering about 15 years, of which 10 was spent in the automotive industry, he has had his share of difficulty with seamy and dirty steel. This, however, represents a very small proportion of the troubles which have occurred in the use of steel and has occurred less and less as practice has improved. Furthermore, the steels made in small quantities with considerable care have by no means lacked representatives which showed this condition.

Much of the condemnation of certain inclusions in steel has arisen from a lack of complete analysis of the factors governing the application of the steel. Many cases of failure which have been stated to be due to inclusions or dirt have been due primarily to faulty design. The effect of a sharp corner or nick is now quite well understood. Tool marks represent a phase of this. When fracture occurs because of tool marks, it is not always a simple matter to demonstrate this, because after it has occurred the mark has disappeared. All steel contains more or less inclusions and if an obscure break occurs it is usually quite a simple matter to find inclusions with which it may be connected. The line of reasoning that the break was not caused by the inclusion but rather followed it along the line of least resistance, being caused by an overload due to the mechanical condition of the steel, requires an intimate knowledge of all the factors which enter in. This example will serve to illustrate the fact that troubles arise frequently for which the condition of the steel is not at all responsible.

The writer is holding no brief for "dirty steel" nor for "tonnage steel" in all cases. There are many cases in which exceeding care is necessary—for example, in tool steel from which costly tools are to be made. This is written to call attention to the fact that "tonnage practice" is not to be condemned in any wholesale way. There may be makers whose practice is such that their steels are marketed in bad condition, but on the other

hand it is not at all difficult to select many whose "tonnage steels" are of excellent quality. Competition will do the rest.

The proof of all this does not lie in any laboratory examination of an individual case carried on in a spirit of condemnation tending to locate the causes in the steel. It comes rather from the results of years of use. The greater bulk of forgings, for example, comes from "tonnage steels," yet we are not confronted by any wholesale failures in service. This applies to the automotive industry as well as to industry in general.

There is another factor which seldom enters into a discussion of this situation but which nevertheless has a very direct effect, and that is cost. In dealing with quality in steel there is often a marked tendency to avoid a discussion of this factor, but in spite of this it has a very direct effect in the final analysis.

To illustrate we will assume that the loss due to dirt inclusions in "tonnage steels" is one-tenth of 1 per cent. That this is a high estimate will be generally admitted if all industry is considered. If to eliminate this it becomes necessary to increase the cost of the raw material 50 per cent or perhaps more, it is quite evident that economic pressure will eventually require a simpler solution. If to this is added a doubt that 100 per cent perfection will be gained, there will be lacking the necessary pressure to force a change.

With proper attention to detail in manufacture—for example, in ingot pouring and cropping—there is no reason why "tonnage steels" should not meet "tonnage requirements"; in fact they are doing so. Lack of careful practice in one mill is no reason for wholesale condemnation of all.

RALPH H. SHERRY.

Elizabeth, N. J.

Problems in Sodium Sulphide Manufacture

To the Editor of Chemical & Metallurgical Engineering

SIR:—I notice with interest what you say in the Jan. 10 issue about methods of making sodium sulphide. There is no real difficulty in making a high-grade product provided the proper furnace be used and it have proper firing. Under these conditions a fused product with very little remaining sulphate may be obtained in a short time. The real difficulties are twofold: First, the temperature necessary is so high that about 5 per cent of the charge volatilizes. Second, the fused sulphide attacks the furnace lining rapidly and destroys it. I have made hundreds of tons of this material by the processes outlined in your editorial and generally failed to get a product containing less than 4 to 6 per cent sulphate. Moreover, by fusing the materials in an atmosphere free from oxygen, so as to avoid reoxidation of the sulphide and giving a chance to the carbon to deoxidize the charge completely, no difficulty is encountered; neither is the fuel cost excessive, since raw bituminous coal is used in the most economical manner.

A combination of this method with the barium process offers the best possible economy, since the furnace cake produced as above may then be dissolved in the somewhat dilute barium sulphide wash liquor, which must be evaporated in any event, giving strong solution for the production of crystal or concentrated sulphide. In boiling down the solution for either of these products the waste heat of the furnace may easily be used for the concentration. In these days of high and scarce fuel such economies spell the difference between a profit or a loss.

EDWARD HART.

Lafayette College,
Easton, Pa.

Art and Science of Leather Manufacture—III

BY F. L. SEYMOUR-JONES*

Vegetable Tanning Consists in Treating the Prepared Hides and Skins With Extracts of Suitable Natural Materials, the Procedure Varying Somewhat Empirically With the Nature of the Stock and the Product Desired, as the Actual Mechanism Is Indefinite

THE preliminary wetwork in preparing the skins having been accomplished, the next process is that of tanning proper. It is difficult to find a satisfactory definition of "tannin." Broadly, a tannin is any substance which precipitates gelatin and converts hide into leather; this covers a wide range of organic and inorganic substances.

Vegetable tanning, one of the most ancient methods, is still that most widely practiced, though for many purposes it has been replaced by chrome and its supremacy in other directions is similarly being challenged. No definite cause for the formation and secretion of tannin by plants is known, though many theories have been suggested. Tannins may occur in roots, wood, bark, leaves or fruit, though not necessarily of the same nature in each part. It is very widely distributed in the vegetable kingdom.

VEGETABLE TANNING MATERIALS

Space will permit of only the more important sources of tannin being mentioned. Of barks, the old standard material was that from the oak, *Quercus robur* and other varieties, more particularly *Quercus prinus*, the chestnut oak, in the United States. The bark contains from 4 to 22 per cent of tannin, but 10 per cent may be considered a good average. It is best peeled in the spring, when the sap is rising, and should be stored under cover from rain. Most barks contain about 6 per cent of soluble non-tanning matter (non-tans), which includes a large percentage of sugar. It is therefore unsuitable for the manufacture of tanning extract, owing to the great liability to fermentation. The bark of the American chestnut oak, owing to its comparatively low non-tan content, is free from this defect, and excellent extract is made therefrom.

Oakwood, though containing only 2 to 4 per cent of tannin, is largely used for extract manufacture in Europe. The tannin is different from that in the bark and more nearly resembles that of the chestnut. The chief source of supply is Slavonia, now of the Jugoslav State, where the chips and waste lumber are utilized for making an extract of around 26 to 28 per cent tannin content.

One of the most important native American tanning materials of today is the true or Spanish chestnut, *Castanea vesca*. This is a tree of rapid growth, the main source being in and about the Appalachian Mountains. The air dry wood averages about 8 per cent tannin, and the bark, which is little used alone, about

the same. Chestnut extract is made from the wood and bark combined as a rule, and will have a tannin content of 36 to 60 per cent. Large quantities are made not only in this country but also in France.

Formerly if not still the most important North American tanning material, the bark of the hemlock fir (*Tsuga canadensis*) is undoubtedly the most characteristic American tannin. The tree is widely distributed over the northern United States and Canada, from Pennsylvania to Alaska. The bark averages 8 to 10 per cent of a reddish tannin. Extract is also made from the hemlock, both solid and liquid varieties finding place in the market.

Other conifers are used to a lesser extent for tannin. The Norway spruce (*Abies excelsa*) is much used in Austria. It contains a large proportion of fermentable sugars, and hence swells well but tans only lightly. The larch (*Larix europæa*) is used somewhat in the British Isles for light leathers, giving a light-colored product of pleasant odor. The Aleppo pine (*Pinus halepensis*), the bark of which contains up to 25 per cent tannin, is largely used along the eastern Mediterranean littoral.

South America provides a largely used material in quebracho. The wood is extremely hard, has a specific gravity of about 1.3, and contains 25 to 28 per cent of a difficultly soluble tannin. The tree grows in scattered groups over much of the Argentine, Chile and Paraguay. Much of the wood is extracted on the ground before export, but part goes to extract plants in this country, Germany, France and England. The difficultly soluble tannin is sometimes rendered more soluble by treatment with alkaline bisulphites or alkalis, which are subsequently neutralized. Such extracts are spoken of as sulphited quebracho. Even the insoluble tannin, however, if suspended in water and agitated with hide, will tan, showing that it is in reality soluble, though with difficulty.



FIG. 15—ROCKER YARD SHOWING HIDES ON FRAME AND ROCKER MECHANISM

*Frank L. Seymour-Jones is the son of Alfred Seymour-Jones, of Wrexham, Wales, who for many years has been one of the foremost tanners of Great Britain and one of the leading scientists of the industry. Frank Seymour-Jones was graduated from the University of Leeds, England, with honors in applied chemistry of leather manufacture, being awarded the Le Blanc medal for special distinction. He now holds the Goldschmidt fellowship at Columbia University, where he is continuing fundamental research on tannery processes.

†Article I of this series appeared in *Chem. & Met.*, vol. 27, No. 23, Dec. 6, 1922; Article II in vol. 27, No. 26, Dec. 27, 1922.



FIG. 16—LAYAWAY YARDS

The acorn cups from the valonia oak (*Quercus aegilops* and other species) form a highly important source of tannin. The small tree is widely spread through western Asia Minor, Greece and the Grecian archipelago, the best quality coming from Smyrna. The tannin content varies from 20 to 40 per cent. The "beard" (the spiky portion surrounding the cup) contains more tannin than the cup proper, and is often sold separately.

Galls occur chiefly on *Quercus infectoria* and other oaks; they contain up to 60 per cent of gallotannin. They are of very little use for tanning, but form the chief source of the tannic acid of commerce and pharmacy.

Sumach is obtained from Sicily (*Rhus coriaria*) and to a lesser extent from Virginia and the Southern States (*Rhus glabra*, *R. typhina* and other varieties). The leaves and small twigs of the bush are used, dried and ground in a primitive fashion with edge-runners. The tannin content of the Sicilian varieties averages about 25 per cent, that of the American 10 to 18 per cent. Few materials are adulterated more, chiefly with leaves of other and similar plants containing much less tannin; in fact, *Pistacia lentiscus* is imported from Algeria to Sicily for this purpose. Adulteration is easily detected by microscopical examination, with suit-



FIG. 17—CHOPPING OFF BELLIES FROM HIDES

able treatment of the leaves. Sumach is chiefly used for light leathers, and gives a light-colored product. It is the best material known for bookbinding leathers, where wear and resistance to gas fumes and city atmosphere are desiderata.

Gambier is a solid or pasty extract obtained from the leaves and twigs of an East Indian shrub, *Nauclea* (or *Uncaria*) *gambir*. It is also known as terra japonica and, in common with various other extracts, as catechu. Until recently the manufacture was entirely in native hands and was crude in the extreme. The leaves and twigs are boiled in open pans until a sirupy liquid is obtained; this is roughly strained and poured out to set. It is exported either as paste, roughly covered with sacking, or in dry cubes of about a cubic inch size. The cube gambier contains 50 to 65 per cent tannin, and the pasty block gambier 35 to 40 per cent.

The mangrove grows on almost all marshy tropical coasts and comprises various species of *Rhizophora*. The bark contains 15 to 40 per cent tannin. It is a material of growing importance, and gives a deep red colored leather.

Myrobalans, the unripe fruit of *Terminalia chebula*



FIG. 18—BLEACHING VATS FOR REMOVING SURFACE TAN

and other East Indian species, contains 30 to 40 per cent tannin in the nut. The stones and kernels of the nut contain no tannin.

Various kinds of acacias and mimosas are largely used, and those known as wattles are of rapidly growing importance. Indigenous to Australia, they have been transplanted to Natal, where a large and flourishing extract industry now thrives. The tree is of rapid growth and the bark contains up to 50 per cent tannin, according to species, though 30 per cent may be taken as a good average. In recent years it has also been developed in Kenya (British East Africa), where the tree reaches maturity for stripping in as short a time as 5 years. Another variety, *Acacia arabica*, is widely used in India and the Near East under the name "babool." I found it in use in Palestine 4 years ago and it may well have been the material of "one Simon, a tanner."

Divi-divi (*Cæsalpina coriaria*) and algarobilla (*C. brevifolia*), two Central American trees, provide tannin in their seed pods, which contain 40 to 45 per cent.

Among other natural tannins of lesser importance may be mentioned the saw palmetto (*Sabal serrulata*) of Florida, a tannin extract being made from its roots, and canaigre (*Rumex hymenosepalum*), a dock growing



FIG. 19—OIL WHEELS

in Arizona, Mexico and southern California, the air dry roots of which contain 25 to 30 per cent tannin, together with a large quantity of starch.

Sulphite cellulose is obtained by concentrating the waste liquors from the manufacture of wood pulp by the sulphite process. It is not a true tanning material, but has found many applications in tanning, particularly in brightening the color and in filling (giving solidity to) sole leather. One firm markets this product as "spruce" extract. True spruce extract is often sold as "larch" extract.

The chemistry of the tannins is as yet little understood. Emil Fischer succeeded in synthesizing what was at least a stereo-isomer of gallotannin, and which was a penta-m-digalloyl-glucose. Freudenberg is continuing his work, and classifies tannins broadly into (a) tannins hydrolyzable with enzymes (tannase and emulsin), in which the benzene nucleus is linked to a larger complex by oxygen atoms, and (b) condensed tannins, in which the nuclei are linked by carbon atoms. The first class comprises (1) depsides (esters of phenolcarboxylic acids with each other or with other hydroxy-acids), (2) esters of phenolcarboxylic acids with polyhydric alcohols and sugars (gallotannin type), and (3) glucosides. Of more practical interest to the tanner is the old and rough classification into pyrogallol

and catechol tannins, according to their derivation. The pyrogallol tannins yield "bloom" (a deposit of ellagic acid) on fermentation or hydrolysis, while the catechols give insoluble "reds" or phlobaphenes. Some tannins—e.g., oak bark—appear to be of mixed origin, and give the characteristic reactions of both groups. Gallotannin, sumach, oakwood, chestnut, myrobalans, valonia, divi-divi and algarobilla belong to the pyrogallol group, and the catechols include pine barks, hemlock, larch, acacias (mimosa, wattle), quebracho, mangrove, canaigre and gambier.

Synthetic tannins or syntans bear no chemical relationship to the natural tannins. The original syntan, Neradol D, was a condensation product of cresol-sulphonic acids with formaldehyde, and this general principle has been widely followed in the overwhelming list of patents granted for the preparation of such substances. Used alone, they are of little value, but in conjunction with natural tannins have found wide applications. They are particularly useful in the preliminary coloring of leather and in the final bleaching or brightening of color.

EXTRACT MANUFACTURE

The grinding of tanning materials prior to leaching varies with the nature of the material and the leaches used. The product must be sufficiently fine to leach

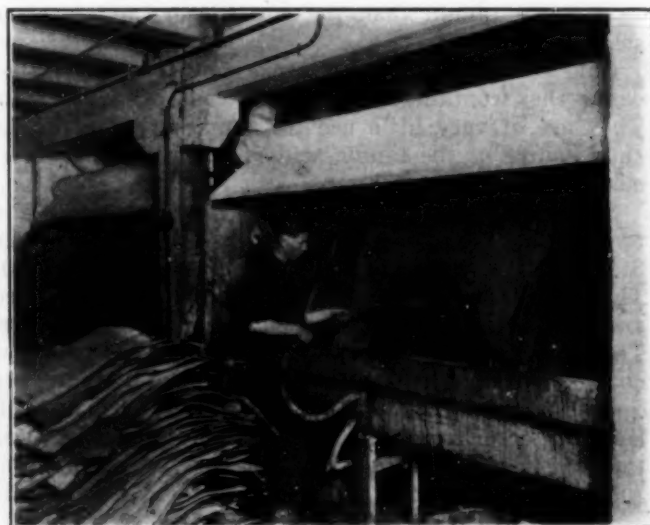


FIG. 21—APPLYING POLISH TO GRAIN



FIG. 20—ROLLING LEATHER FOR FINISH

easily and completely, yet not so fine as to clog the leaches and cause incomplete extraction of tannin. Various types of mills are employed, with steel blades or teeth to cut and rasp the materials. Disintegrators are widely used. Crushers are used for fruits such as myrobalans. The ground material is conveyed to the leaches by some form of mechanical conveyor—belt or bucket. The heat and dust developed during grinding are very great and cause a large fire hazard. Consequently it is usual, where tanneries grind some of their own materials, to locate the grinding machinery in a building apart from the main factory. Iron from the grinding machinery is very objectionable in the tan liquors, since it forms ink.

The ordinary battery of leaches consist of a series of pits or tubs provided with false bottoms and with an eye in each connecting to the next leach. The extracting water, heated as desired, is passed through these in turn, flowing from one to the next by gravity



FIG. 22—SETTING OUT MACHINE FOR SMOOTHING OUT GRAIN

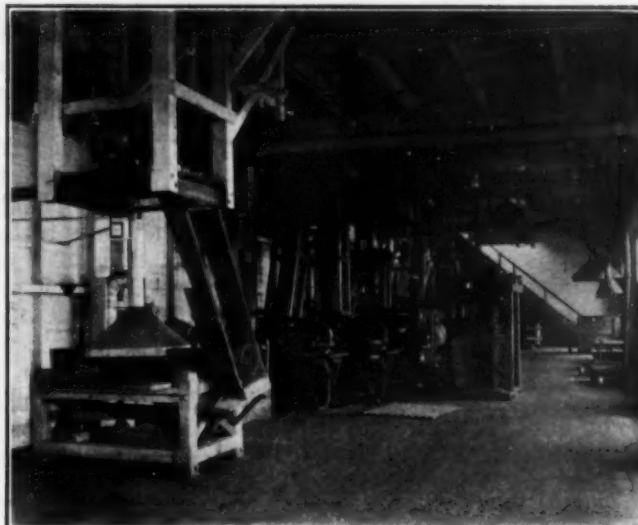


FIG. 24—ROLLING HEAD MACHINES

or being pumped. The fresh water passes through the nearly spent tan, then on to the next, and through the series to the fresh material. Cold extraction gives a lighter and brighter colored liquor, while hot (not necessarily boiling) water extracts more tannin. The majority of tanning materials yield most tannin at 80 to 90 deg. C., but some, like sumach, canaigre and valonia, extract most at 50 to 60 deg. C.

In extract manufacture and in some tanneries the liquors are concentrated by evaporation, in evaporators of the triple effect or climbing film types. Evaporation is completed in vacuum pans, until the well-stirred liquor is sufficiently sirupy to solidify on cooling. Both solid and liquid extracts are largely made. The former offer economy in transit charges, but are not always so satisfactory in getting back into solution again. Extraction at high temperatures causes a darkening of color of the extract, and where necessary extracts are decolorized by the use of blood albumen, coagulated by heating the liquor or by some other suitable absorbent. Naturally this causes some loss of tannin, but since the leather buyer purchases largely on color, the tanner must demand light-colored extracts from the extract manufacturer.

Tannage proper consists in working the skins through

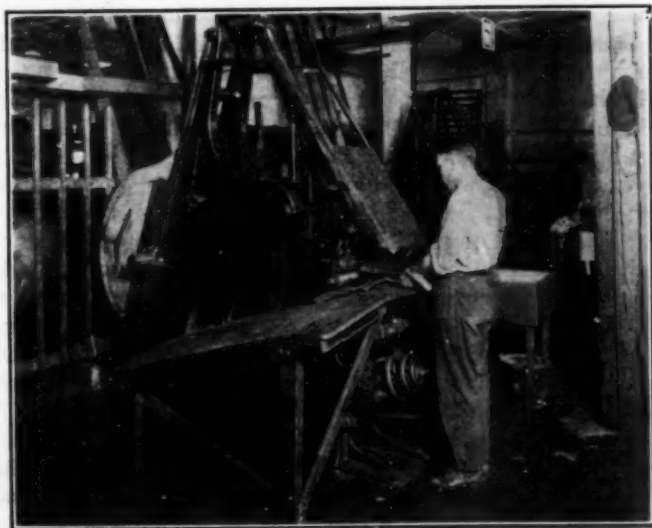


FIG. 23—JACKING THE HEADS

a series of tan liquors of gradually increasing strength. The strength of tan liquors is usually expressed in degrees barkometer. This instrument is merely a hydrometer, and affords a rough means of gaging the strength of liquors. One deg. Bkr. is equal to 1.001 specific gravity, 10 deg. Bkr. to 1.010 sp.gr., and 100 deg. Bkr. to 1.100 sp.gr., etc.

The materials, liquors and methods used vary according to the class of skins and the nature of product desired. For sole and belting leather, where the product is sold by weight, a heavy tannage is required, while for light leathers, sold by area, a sufficient but not excessive tannage is given.

TANNING PROCEDURE

Taking sheep as typical of light stock, the first process is coloring. The color of the product is largely determined by the first early tannage. The skins are therefore paddled in a weak sumach (or other suitable) liquor, which will insure a light-colored product. Subsequent tannage may be by suspension in pits with periodical handling of the skins or agitation of the liquor, or paddling, or drumming. Naturally the two latter are more rapid, but if too violent loosen the skins out excessively. The strength of the liquors must be increased only gradually. If too strong and astringent liquors are used at first, the grain of the skin becomes drawn and case-hardened, and prevents the further penetration of tannin into the interior of the skin. Many materials are used in tanning, but for the finer classes of leather pyrogallol tannins are preferred, notably sumach, oak bark and wood, chestnut and larch.

The tanned skins are nailed on boards to dry in heated sheds, or may pass through a tunnel drier. They are then wet back and shaved. Shaving consists in reducing the skin to an even thickness by paring off on the flesh side, either by hand with a knife with a turned edge, or by machine, with a rapidly revolving spiral blade roller pressing the skin against a rubber roll. The skins then pass to dyeing and finishing.

Sheepskins are naturally extremely greasy and are therefore usually degreased. This is accomplished either by hydraulic pressing between brass plates after coloring, or by extraction with naphtha after tanning and dyeing, but before finishing. The naphtha is recovered. The grease finds a market for the manu-

facture of stuffing greases and similar products. The fire risk of a spirit degreasing plant is very high, and special precautions have to be taken to prevent any sparking of machinery, even belts being protected by points to avoid electrical sparks.

With heavy leather (sole leather, etc.) the hide commences in the suspenders, a weak but acid liquor, to insure complete neutralization of lime and good plumping, being used to color the leather. They pass to the rockers or handlers, through a series of liquors of increasing tannin content, where the suspended hides are rocked mechanically to insure even tannage. Next they go to the layers or dusters, where the hides (or bends) are placed horizontally in a pit, a layer of ground tan is dusted over the hide, another hide placed on top, and so on until the pit is full. The pit is then filled up with strong liquor. The hides pass through a series of these layaways. When tannage is completed—which may take from 3 to 6 months, although the hides are half tanned in 10 to 14 days—the leather is dipped in warm water to clean it, swabbed over with cod oil, dried, damped back and piled to samm (semi-dry), oiled on the grain, and rolled with a brass roller.

After tannage proper it is usual to fill the leather to get firmness and weight. The sides are dipped or drummed in a strong, hot, neat tannin extract or sulphite cellulose. They are then bleached, by dipping into hot water, soda, dilute sulphuric acid, and water in turn. They pass through a wringer, and are next loaded. Loading is straight adulteration, necessary to get weight to sell at a competitive price. It cannot be said to affect the wearing quality of the leather adversely, but the deliquescent nature of some of the substances used renders the leather readily water-absorbent, and its harmful nature is obvious. Some countries, notably Australia and Sweden, have taken action to prevent the import of loaded leather. The usual substances are glucose, epsom salts (magnesium sulphate) and barium sulphate. The first two are drummed in with oil, while the last is implanted by alternate dippings in sulphuric acid and barium chloride.

The sequence of operations at the J. H. Ladew Co. for tanning and finishing sole leather is illustrated by Figs. 15 to 25. As will be noted in Figs. 15 and 16, the hides are handled in the rocker and layaway yards by means of a monorail hoist. The use of an electric traveling crane for this purpose is shown in Figs. 26 and 27.

Many rapid tannages for sole leather have been tried, usually consisting in drumming the goods in concentrated liquors after a short preliminary coloring in weaker liquors. This is in general unsuitable for sole leather, as it is impossible to get the necessary firmness



FIG. 25—DRYING LEATHER



FIG. 26—ROCKER YARD WITH ELECTRIC TRAVELING CRANE

and solidity by a straight drum tannage. Used in conjunction with suspension methods, it has met with some success.

One method of vacuum tanning has achieved some popularity, though not yet employed very extensively—namely, that known as the Nance process. The difficulty in any vacuum tannage is that, for the tan liquor to enter the hide, the pressure must be so reduced that the water in the hide capillaries boils out, leaving a vacuum. This the Nance process accomplishes. The liquors used are then introduced at about 25 deg. C., and rapidly penetrate the hide.

Many materials are used in heavy leather tannage, hemlock, chestnut and chestnut oak extracts being favorites. In the layers, for dusting materials, valonia, algarobilla, and ground bark are used. When pyrogallol tans are employed, the bloom deposited on the grain may either be left on or removed by scouring, according to the type of product required by the buyer.

Belting and other leathers are usually carried—i.e., stuffed with greases to render them waterproof—and then finished. The bloom is scoured off by machine, the hides are skived or shaved and then stuffed. Stuffing is carried out either by hand or in the drum. A suitable mixture of cod oil, tallow and stearine is applied to the damp leather. The stuffed leather is "set out"—i.e., stretched out flat and all wrinkles removed, either by hand or machine. Belting leather is finally stretched by machine. Stuffing is often carried out hot, a temperature of 90 deg. C. or over being used. In this case the leather must be absolutely dry before entering the drum or it will be seriously damaged. In passing it may be remarked that dry leather will stand much higher temperatures than wet, and that chrome-tanned stands heat better than vegetable-tanned. Since the tanner takes days to dry his hides, it is scarcely reasonable to expect to dry a pair of wet boots satisfactorily by a hot radiator in an hour or so.

The choice of materials and their blending to produce the desired effect in any kind of vegetable tanning is an art in itself and also requires knowledge of the constituents. The soluble extract from any tanning material contains a greater or less proportion of non-tans, part of which consists of readily fermentable sugars. These yield acids, which tend to plump the leather. A high tan:non-tan ratio in a material means a highly astringent liquor, such as straight quebracho, while the greater the proportion of non-tans the milder and mellow the liquor. Gambier is an example of a mild material. Even such a highly astringent material as

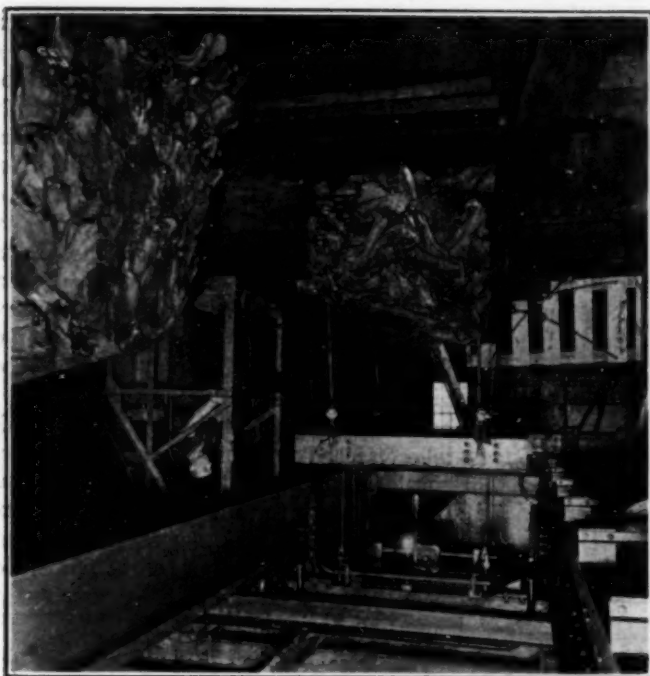


FIG. 27—LAYAWAY YARD WITH ELECTRIC TRAVELING CRANE

quebracho can be rendered as mild as gambier by addition of suitable non-tans.

Molds are an occasional source of loss in tan liquors. Their action is due to the secretions of an enzyme, tannase, which hydrolyzes certain classes of tannins. At the same time the molds utilize the tannin as a source of carbon nutriment, where other carbonaceous matter is absent.

There are many theories of vegetable tanning, none yet susceptible of exact proof. They range from pure physical adsorption of the tannin by the hide fibers to a definite chemical combination between hide protein and tannin. One very plausible theory holds that the negatively charged tannin particles and the positively charged hide (on the acid side of its isoelectric point) mutually precipitate each other, just as in the mutual precipitation of colloids. Unfortunately for this, it is quite possible to tan hide in an alkaline solution, so it will require some modification. Needless to say, alkaline tanning is entirely impracticable, since large excess of tannin has to be used, though it is definitely fixed by hide powder. One thing is certain—that combination between hide and tannin is slow and not immediate. Freshly tanned hide powder loses its tannin if extracted *wet* with alcohol, but not after drying. The tannin can be easily stripped from *freshly* tanned hide powder with alkalis, but not after the tanned hide powder has been aged for some time. The whole subject is as yet too indefinite to make any detailed statements of value, and it will be necessary to wait until more is known of the chemical nature of tannins and hide before a definite explanation can be adduced.

ACKNOWLEDGMENT

Illustrations for this article were made available through the courtesy of the J. H. Ladew Co., Newark, N. J. (Figs. 16 to 25); *Compressed Air Magazine* (Fig. 15); Pawling & Harnischfeger, Milwaukee, Wis. (Figs. 26 and 27).

(Another article on the art and science of leather manufacture will appear in a subsequent issue.)

Developments and Tendencies in the German Potash Industry*

Stassfurt Giving Way to Hannover and South Harz District—Production and Sale—Government Control—French Competition

BY WILLIAM T. DAUGHERTY

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THE war left to Germany at least one self-contained industry—the potash industry. The pre-war monopoly enjoyed by Germany, broken by the loss of the potash mines in Alsace Lorraine under the peace treaty, is nevertheless not as seriously threatened now as the first signs after the war would have seemed to indicate. The superiority of German deposits—i.e., the purer and more abundant deposits of salts and the simultaneous occurrence of carnallite ($\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$), sylvanite ($x\text{KCl} \cdot y\text{NaCl}$), kainite ($\text{K}_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$), kieserite ($\text{MgSO}_4 \cdot \text{H}_2\text{O}$)—as well as lower costs of production, favors Germany on the world market. Germany's expectation of setting a record of sales in the calendar year 1922—i.e., probably around 1,330,000 tons of potash (K_2O), or 220,000 tons more than in 1913, out of which total 24.8 per cent has been for foreign sales in the first 10 months of 1922 (against 45 to 50 per cent in 1913)—seems to confirm this claim. Energetic plans are in progress to penetrate America and recover Germany's most important pre-war market.

SHIFTING OF PRODUCTION CENTERS

Production centers of the German potash industry are roughly five—namely: (1) The Hannover district, (2) the South Harz district, (3) the Werra (Thuringia) district, (4) the Stassfurt district and (5) the Halle, Mansfeld and Unstrut district, in the order of their approximate production in terms of K_2O in the first 6 months of 1922. In October, 1922, 128 shafts were being actively worked in all Germany, while 83 shafts were idle, according to the "Kaliprüfungsstelle," of Berlin, an official organization, calculating the participation of all German works in total sales.

Rich and abundant supplies of German potash, lying near the surface, or more profitably worked for richer content if lying deeper, permit a variety of choice of location for new works. The shifting, for instance, of production centers within the past year, so that the famous Stassfurt district, which occupied second place in production in 1921, fell to fourth place during the first 6 months of 1922, is proof of the growing importance of the South Harz district.

This shifting of production centers is not necessarily borne out by the number of active shafts in operation, as some shafts in respective districts are worked more intensively than others. In October, 1922, the Hannover district operated the largest number of shafts—namely, 54 shafts out of 79; the South Harz district, 24 out of 33; Stassfurt, 24 out of 43; the Werra, 14 out of 27; Halle, etc., 12 out of 29.

PRODUCTION AND SALES

Production.—Production of all crude salts by districts in the years indicated is shown in Table I.

The potash content from this production is shown in Table II.

*Abstracted from a special report, received Jan. 17, 1923, by Western European Division, Bureau of Foreign and Domestic Commerce, Department of Commerce.

TABLE I—PRODUCTION OF CRUDE POTASH SALTS IN GERMANY, BY DISTRICTS (In Metric Tons)

District	1913	1920	1921	1922*
Hannover.....	(Regional figures not available in 1913)	3,508,544	2,912,997	5,812,220
Stamfurt.....		2,242,192	1,989,829	2,038,560
South Hars.....		2,005,122	1,746,431	2,283,520
Werra.....		2,037,862	1,457,128	2,373,960
Halle-Mansfeld, etc.....		1,562,385	1,134,794	1,279,160
Totals.....	11,604,511	11,356,105	9,241,179	11,787,420

* Loosely estimated on the basis of twice the production in the first 6 months of 1922. Total production figures of K_2O can probably be discounted by around 25,000 tons.

TABLE II—PRODUCTION OF POTASH (K_2O) IN GERMANY, BY DISTRICTS (In Metric Tons)

District	1913	1920	1921	1922
Hannover.....	(Regional figures not available in 1913)	407,822	334,426	446,620
Stamfurt.....		225,454	215,494	215,620
South Hars.....		269,060	231,720	299,080
Werra.....		233,128	170,819	273,160
Halle-Mansfeld, Unstrut.....		161,463	114,390	131,080
Totals.....		1,296,929	1,066,849	1,365,560

TABLE III—TOTAL SALES OF GERMAN POTASH SALTS (In Metric Tons)

Year	Inland	Foreign	Total
1913.....	604,283	506,087	1,110,870
1914.....	537,809	366,179	903,988
1915.....	567,098	112,779	679,877
1916.....	721,044	158,932	879,976
1917.....	871,478	132,893	1,004,371
1918.....	859,716	141,947	991,663
1919.....	637,033	174,970	812,003
1920.....	689,391	234,252	923,643
1921.....	768,477	152,670	921,147
1922*.....	997,500	332,500	1,330,000

* Estimated.

Sales.—Table III shows the total sales of German potash salts, in terms of K_2O content, to inland and foreign purchasers in the years indicated. It is observed from this table that except for the year 1921 foreign sales have increased progressively in post-war years. Germany's best customer for potash salts in 1913 was the United States, with purchases of 236,884 tons of K_2O ; Holland came next, purchasing 43,478 tons, while France bought 33,115 tons. Although foreign sales have decreased in volume in post-war years, the same relative importance of these markets is probably not appreciably changed, as, for instance, figures for 1920 show. In that year the United States bought 83,602 tons of K_2O from Germany; Holland, 54,347 tons; England, 11,414, and France, 1,975, according to figures given by the German Potash Syndicate.

POTASH CONTROL IN GERMANY

After various experiments to regulate production and sales of potash extending over a period of about half a century, the German Reichstag passed the so-called federal potash law on May 25, 1910. This law provided that the government, and not the Potash Syndicate, be empowered to fix inland prices for potash. It also took from the syndicate the right to prescribe the amounts of participation of the various concerns (groups) in total sales, and created a so-called "distribution center" (Verteilungsstelle) for this purpose. At the same time, however, an appeal commission was created with power to hear appeals against decisions of the distribution center. The real organization of the Potash Syndicate was not directly affected by this law. This organization was regulated through the members, as well as through the sales agreement. Until the outbreak of the revolution (November, 1918), the organization was not changed.

Socialist parties with majority votes in the Reichstag after the revolution contemplated the socialization of Germany's potash resources. As this proposal was confronted with too many difficulties, another alternative was chosen—namely, the creation of a federal potash council (Reichskalirat) with power to control the German potash industry.

The Federal Potash Council is composed of thirty members, and includes representatives of the potash producers, dealers and wholesale consumers (agriculture and the chemical industry). In addition, three members of the Potash Syndicate are admitted, as well as one expert in potash mining. Employers and labor are represented in equal number in the council.

Along with the council are other bodies, such as the "Kaliprüfungsstelle," already mentioned, and the appeal office. Both of the latter perform the same duty as was written into the law of 1910 for the distribution center and the appeal commission. The potash producers themselves are organized into a sales organization, which is the Potash Syndicate, which alone has the right to sell potash at home and abroad.

IMPORTANCE OF GERMAN MONOPOLY

Until the end of the war Germany had, *de facto*, a potash monopoly. This monopoly was partly broken by the granting of approximately thirteen potash shafts to France in connection with the cession of Alsace Lorraine. At that time the thirteen shafts were not all in operation, but they were rapidly improved and thrown into competition with German production. Alsatian competition is, however, probably handicapped by the existence of far fewer mines and concentrating plants, as well as a none too great occurrence of sulphate salts. Kieserite ($MgSO_4$), used in Germany in the production of potassium sulphate and potassium-magnesium sulphate, is absent completely from Alsatian deposits.

In order to overcome this handicap, attempts have been made to employ sulphuric acid on potassium chloride, but the production costs are said to be too great to permit profitable competition. The occurrence of clay in Alsatian deposits is said to offer another disadvantage in the most profitable concentration of the raw salts. Freight competition is another factor to be taken into consideration. The distance to nearest harbors—namely, Antwerp and Rotterdam—is greater than from German mines to Bremen and Hamburg.

The German industry is apparently not greatly concerned over the new French competition. French exports of potash to the United States are roughly estimated by German authorities as not exceeding 20 per cent of all sales to our country, but it is claimed that the French are selling at a loss (with possible subsidies), and that competition will diminish, on account of inability to compete with German prices. The contention regarding the subsidy of the French industry cannot be verified here, but it is vigorously denied in official French quarters in Berlin.

Negotiations between Alsatian and German producers have been attempted with a view to agreeing upon a uniform price policy, but without success, and the present prospect is that Germany will probably continue to underbid French producers. If German claims are justified, the German control of the international potash trade appears to be not very seriously affected by the separation of the Alsatian potash mines.

Conditions for Perfect Rectification of Binary Mixtures

The Relations Existing in a Simple Adiabatic Rectifier Are Discussed and the Possibility of Perfect Rectification Is Analyzed—Special Case of Proportionality Latent Heats

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THE term rectification, as commonly used, refers to a variety of operations or processes wherein either evaporation or condensation or both are employed to purify or change the composition of physical mixtures. In the following pages, however, the term is understood in general to refer to the interaction between a continuous stream of a mixed liquid at its boiling temperature in intimate physical contact with a continuous stream of vapor at its condensing temperature flowing in the opposite direction.

The conduit or passages through which the two streams flow in contact with each other we shall speak of collectively as a "rectifier" or "column." Any fluid, liquid or vapor, as it enters the rectifier or column, we shall call a feed, and any fluid leaving the rectifier we shall call a product. Any portion or section of a rectifier which is insulated from outside heat effects by conduction is called adiabatic. We shall first develop a series of general equations applying to an adiabatic rectifier with one liquid feed and one vapor feed only, these two feeds entering at opposite ends of the rectifier. Such an arrangement we shall call a simple rectifier.

EQUATIONS FOR A SIMPLE RECTIFIER

Suppose a continuous stream of a liquid mixture of two components enters the top of a rectifying column wherein for convenience it may be assumed to cascade over a large number of "trays" of the usual form, and suppose that this liquid as it descends is in intimate physical contact with an ascending saturated vapor which enters the rectifying column at the bottom.

Assume that the system is perfectly insulated, and let the fractional composition of the liquid feed in the more condensible component be x_1 , and let the mass of liquid entering the column per unit time be M_1 . Let the fractional composition in the same component of the vapor feed be y_2 and the mass thereof entering the column per unit time be m_2 . Let the composition of the vapor leaving the top of the column be y_1 and the composition of the liquid product leaving the bottom be x_2 . Then the following equations must hold in all cases. In these equations m_1 is the mass of vapor leaving the top of the column and M_2 is the mass of liquid leaving the bottom and the unit of mass may be taken either as 1 gram or as 1 gram molecule, or mol. If the mol is the unit of mass, compositions must be taken as molecular compositions—i.e., fractional compositions by volume when the mixture is in a condition approaching that of a perfect gas.

In the first place the total mass of the fluids entering

the column must be equal to the total mass of the fluids leaving. Hence,

$$M_1 + m_2 = M_2 + m_1$$

Second, a similar relation holds for the masses of the more readily condensible component—i.e.,

$$x_1 M_1 + y_2 m_2 = x_2 M_2 + y_1 m_1$$

Third, the sum of the values of the "total heat" function for all fluids entering the apparatus must equal the same quantity for the fluids leaving—i.e., if I_1 is the total heat per unit mass of the liquid M_1 , and I_2 the same quantity for the liquid M_2 , and J_1 and J_2 the corresponding quantities for the vapors m_1 and m_2 , the following equation holds:

$$I_1 M_1 + J_2 m_2 = I_2 M_2 + J_1 m_1$$

From these three equations any three of the four masses, say M_1 , m_1 , m_2 , may each be determined in terms of the total heats I_1 , I_2 , J_1 , J_2 , the compositions x_1 , y_1 , x_2 , y_2 and the remaining mass, say M_1 .

The "total heats," I_1 , I_2 , J_1 , J_2 , are, in all cases, determined by the physical properties of the corresponding fluids and hence cannot be regarded as independent variables. Since we have three equations among the remaining eight "variables," x_1 , M_1 , x_2 , M_2 , y_1 , m_1 , y_2 , m_2 , we may regard any five of them as independent—i.e., their values may be stipulated or assigned in advance, and then the three remaining are determined by the above equations.

Of the five independent variables, however, among which must be included at least one of the quantities x_1 , y_1 , x_2 , y_2 , there is always one composition at least that is determined by conditions in the rectifier of which the above equations take no account. The basis of this statement will appear as we proceed.

Solving our system of equations for M_2 , m_1 and m_2 , we obtain:

$$M_2 = \frac{(J_1 - I_1)(y_2 - y_1) + (J_2 - J_1)(x_1 - y_1)}{(J_2 - I_2)(y_2 - y_1) + (J_2 - J_1)(x_2 - y_2)} M_1$$

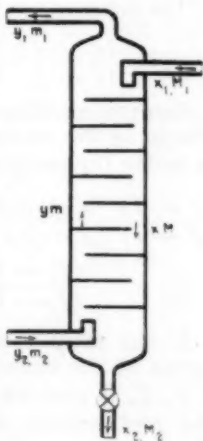
$$m_1 = \frac{(J_2 - I_2)(x_2 - x_1) + (I_2 - I_1)(x_1 - y_1)}{(J_2 - I_2)(y_1 - y_2) + (J_2 - J_1)(x_2 - y_2)} M_1$$

$$m_2 = \frac{(J_1 - I_1)(x_2 - x_1) + (I_2 - I_1)(x_1 - y_1)}{(J_2 - I_2)(y_2 - y_1) + (J_2 - J_1)(x_2 - y_2)} M_1$$

Now in assigning values of the variables x_2 and y_1 , these being the compositions of our products, we must take account of certain limitations. For example, it is impossible to produce a liquid M_2 whose composition x_2 differs more widely from the composition y_2 of the vapor m_2 than does the composition of that liquid which would have phase equilibrium with the vapor m_2 . That is, the maximum possible value of x_2 is x_{y_2} , the composition of a liquid in phase equilibrium with the vapor y_2 . Similarly, the minimum possible value of y_1 , the composition of the vapor product, is y_{x_1} , that of the vapor having phase equilibrium with the liquid x_1 .

If we assume perfect contact between liquid and vapor

Chem. & Met., Jan. 31, 1923.



in the column, we may suppose that x , and y , can attain these values. Then if m , be taken as less than the value fixed by the above three equations under these conditions, x , y , and M , being kept constant, the composition y , of the vapor leaving the top of the column will still be the composition for phase equilibrium with the incoming liquid, but the composition x , at the bottom will decrease—i.e., we shall obtain a liquid product whose composition in the more condensible component is less than that for phase equilibrium with the incoming vapor. If, on the other hand, m , be made larger than the value fixed by the three equations just written, the composition x , will still be that for phase equilibrium with the incoming vapor y , while the composition y , of the vapor product will increase—i.e., we shall obtain a vapor whose composition in the more condensible component is greater than for phase equilibrium with the incoming liquid.

The equation for M , may be written in the form:

$$\left[J_1 - I_1 + (J_2 - J_1) \frac{x_1 - y_1}{y_2 - y_1} \right] M_1 = \left[J_2 - I_2 + (J_1 - J_2) \frac{x_2 - y_2}{y_1 - y_2} \right] M_2$$

This equation may be regarded as defining equivalence between the liquid M_1 admitted at the top and the liquid M_2 obtained at the bottom.

In the particular case where $x_1 = y_1 = 1$, $x_2 = y_2 = 0$, it takes the form:

$$(J_1 - I_1) M_1 = (J_2 - I_2) M_2$$

In this case, however, since each one of the fluids M_1 , M_2 , m_1 , m_2 , contains only one component, the quantities $J_1 - I_1$ and $J_2 - I_2$ are the latent heats of evaporation in the pure condition of the two components respectively, and the last equation may be written:

$$L_A M_1 = L_B M_2$$

where L_A is the latent heat of the more volatile component and L_B is the latent heat of the more condensible component. For two substances for which $L_A = L_B$, the last equation would become:

$$M_1 = M_2$$

In the equation

$$\left[J_1 - I_1 + (J_2 - J_1) \frac{x_1 - y_1}{y_2 - y_1} \right] M_1 = \left[J_2 - I_2 + (J_1 - J_2) \frac{x_2 - y_2}{y_1 - y_2} \right] M_2$$

we note that each of the quantities $J_1 - I_1$ and $J_2 - I_2$ is the difference between the total heat per unit mass of a liquid mixture and that of the vapor in phase equilibrium with it.

These quantities constitute much the larger part of the respective coefficients of M_1 and M_2 , since $J_1 - I_1$ is the difference of the total heat per unit mass of two saturated vapors at the same pressure, and the fractions

$$\frac{x_2 - y_2}{y_2 - y_1}, \frac{x_1 - y_1}{y_1 - y_2}$$

approach zero as the end products approach 100 per cent purity—that is, as $x_1 = y_1 = 1$, and $x_2 = y_2 = 0$.

In general, whatever the compositions x , y , x_1 , y_1 , if it should happen that $J_1 = J_2$ and $I_1 = I_2$, we have:

$$M_1 = M_2$$

and

$$m_1 = m_2 = \frac{x_2 - x_1}{y_2 - y_1} M_1$$

Consider next a level in the column where the composition of the descending liquid is x , x being greater than x_1 and less than x_2 , and let the mass of descending

liquid passing this level per unit time be M . Let the composition of the ascending vapor at this level be y , and the mass passing per unit time be m . Then it is clear that the composition y cannot be less than the composition of a vapor having phase equilibrium with the descending liquid of composition x .

At this point, however, under the conditions specified, the value of y may be determined as a function of x with the values of x_1 , y_1 , x_2 , and y_2 as constants from the six following equations:

$$\begin{aligned} M_1 + m_1 &= M_2 + m_2 \\ x_1 M_1 + y_1 m_1 &= x_2 M_2 + y_2 m_2 \\ L_1 M_1 + J_1 m_1 &= L_2 M_2 + J_2 m_2 \\ M_1 + m &= M + m_1 \\ x_1 M_1 + y m &= x M + y_1 m_1 \\ I_1 M_1 + J m &= I M + J_1 m_1 \end{aligned}$$

From all these equations all (M, m) 's may be eliminated and thus a relation be obtained between x and y containing the constants I_1 , I_2 , J_1 , J_2 , x_1 , y_1 , x_2 , and y_2 . Hence we conclude that if the ratio $x:y$ thus determined is everywhere equal to or less than the ratio for phase equilibrium, it is possible for the rectification to be complete or "perfect"—i.e., we can obtain a vapor at the top having phase equilibrium with the incoming liquid and at the same time obtain a liquid at the bottom having phase equilibrium with the incoming vapor. If the ratio between x and y is anywhere greater than that for phase equilibrium, it is impossible for the rectification to be complete unless either some liquid or some vapor be removed at some intermediate level or levels in the column. If the ratio is everywhere less than that for phase equilibrium, then a limited amount of liquid of composition x between x_1 and x_2 or a vapor of composition y between y_1 and y_2 may be added at a point between the top and bottom of the column without changing the composition of the vapor or of the liquid leaving it.

We have found above that the value of m_1 as obtained from the first three equations is:

$$m_1 = \frac{(J_2 - I_2)(x_2 - x_1) + (I_2 - I_1)(x_1 - y_1)}{(J_2 - I_2)(y_2 - y_1) + (J_2 - J_1)(x_2 - y_2)} M_1$$

Since the same relation holds at an intermediate point in the column, we have

$$m_1 = \frac{(J - I)(x - x_1) + (I - I_1)(x_1 - y)}{(J - I)(y - y_1) + (J - J_1)(x - y)} M_1$$

Comparing this with the last equation written, we obtain as the necessary relation between the x 's and y 's in order for perfect rectification to be possible:

$$\begin{aligned} \frac{(J - I)(x - x_1) + (I - I_1)(x_1 - y)}{(J - I)(y - y_1) + (J - J_1)(x - y)} &= \\ \frac{(J_2 - I_2)(x_2 - x_1) + (I_2 - I_1)(x_1 - y_1)}{(J_2 - I_2)(y_2 - y_1) + (J_2 - J_1)(x_2 - y_2)} \end{aligned}$$

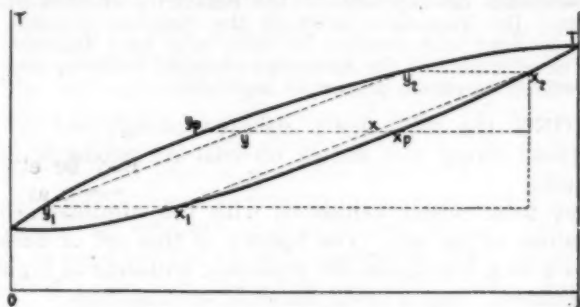
If the ratio $x:y$ determined by the last equation in terms of the various constants, x_1 , x_2 , y_1 and y_2 , I_1 , I_2 , J_1 , J_2 , is greater than the ratio for phase equilibrium, the rectification is clearly impossible—i.e., we cannot obtain a vapor at the top having phase equilibrium with the incoming liquid and at the same time obtain a liquid at the bottom having phase equilibrium with the incoming vapor, since it is impossible at any level in the column for ascending vapor and descending liquid to differ in composition more widely than for phase equilibrium. The properties of those binary mixtures for which the ratio $x:y$ is everywhere less than the value for phase equilibrium and thus for which perfect recti-

fication, as we have exemplified it, is possible are made evident by considering the T - x diagram.

Consider the special case where $I_1 = I_2 = I$ and $J_1 = J_2 = J$. Under these conditions, the above relation between the x 's and y 's reduces to:

$$\frac{x - x_1}{y - y_1} = \frac{x_2 - x_1}{y_2 - y_1}$$

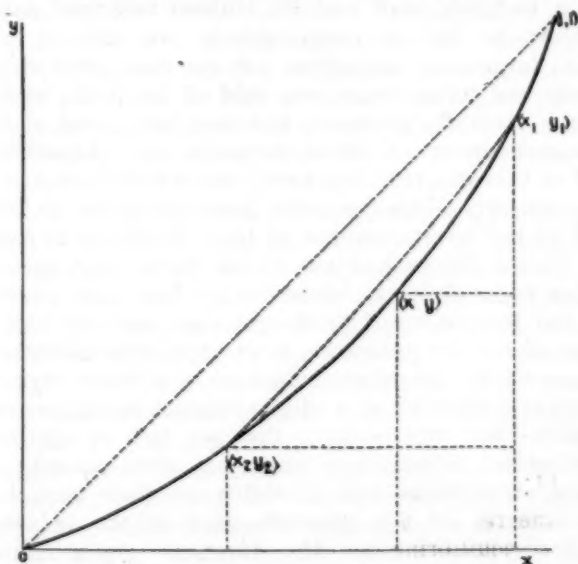
Let the values of the x 's and y 's be as indicated in the diagram. Then it is clear that if y lies on the straight line connecting y_1 and y_2 , x must lie on the straight line connecting x_1 and x_2 , since the segments on



each of a system of lines passing through a point intercepted between a system of parallel lines are proportional. Hence, we may conclude that under the assumed condition, $I_1 = I_2 = I$, and $J_1 = J_2 = J$, in order for the rectification to be impossible—i.e., for the difference between x and y to be greater than that for phase equilibrium—the lower boiling point curve must, at some portion of its length, be such that the horizontal distance measured to the right from the point x_p on the curve to the point x on the chord drawn from x_1 to x_2 is greater algebraically than is the corresponding quantity measured also to the right for the dew point curve—i.e., such that $x_p x > y_p y$, both distances being taken positive when measured to the right from the equilibrium curve.

If we confine the discussion to mixtures which do not possess a constant boiling composition between x_1 and x_2 , these being the only mixtures for which perfect rectification is possible for all ranges of composition, then it follows from the foregoing result that for perfect rectification to be impossible (i.e., for the difference $x - y$ to be greater than $x_p - y_p$) either the dew point curve must contain inflexions between the points y_1 and y_2 , or else the boiling point curve contains inflexions between x_1 and x_2 .

If we consider a diagram in which values of x are



abscissas and values of y are ordinates, the condition

$$\frac{x_2 - x_1}{y_2 - y_1} = \frac{x - x_1}{y - y_1}$$

implies that the point (x, y) lies on the line connecting the points (x_2, y_2) and (x_1, y_1) and hence between the points (x_1, y_1) and (x_2, y_2) , the curve, which must be everywhere below the line defined by the points $(0, 0)$ and $(1, 1)$ contains two or more inflexions. In such a case, even though it would be impossible to obtain perfect rectification with the given end compositions x_1, y_1, x_2, y_2 , still it would be possible to obtain perfect rectification if the end compositions were taken closer to 100 per cent purity respectively—i.e., if x_2 and y_2 were taken closer to 1, and x_1 and y_1 closer to zero—since as this condition is approached, it is impossible for (x, y) to lie on the line between (x_1, y_1) and (x_2, y_2) unless $x = y$, this latter being the condition for a constant boiling mixture.

The relation between x and y may be obtained in another form, which will be useful later, by properly changing subscripts in the solutions of our original three equations thus:

$$m = \frac{(J_1 - I_1)(x - x_1) + (I_1 - I_1)(x_1 - y_1)}{(J_1 - I_1)(y - y_1) + (J_1 - J_1)(x - y)} M_1$$

and also

$$m = \frac{(J_2 - I_2)(x_2 - x) + (I_2 - I_2)(x_2 - y_2)}{(J_2 - I_2)(y_2 - y) + (J_2 - J_2)(x_2 - y_2)} M_2$$

but

$$M = \frac{(J_1 - I_1)(y - y_1) + (J_1 - J_1)(x_1 - y_1)}{(J_1 - I_1)(y - y_1) + (J_1 - J_1)(x - y)} M_1$$

whence

$$m = \frac{(J_1 - I_2)(x_2 - x) + (I_2 - I_1)(x_2 - y_2)}{(J_2 - I_2)(y_2 - y) + (J_2 - J_2)(x_2 - y_2)} \frac{(J_1 - I_1)(y - y_1) + (J_1 - J_1)(x_1 - y_1)}{(J_1 - I_1)(y - y_1) + (J_1 - J_1)(x - y)} M_1$$

Comparing this with the first relation between m and M_1 , we obtain

$$\frac{(J_1 - I_1)(x - x_1) + (I_1 - I_1)(x_1 - y_1)}{(J_1 - I_1)(y - y_1) + (J_1 - J_1)(x_1 - y_1)} = \frac{(J_2 - I_2)(x_2 - x) + (I_2 - I_1)(x_2 - y_2)}{(J_2 - I_2)(y_2 - y) + (J_2 - J_2)(x_2 - y_2)}$$

as an alternative form of the x, y relation.

PROPORTIONALITY LATENT HEATS

A particular case of considerable interest is that where we are dealing with two components having unequal latent heats but which have the property that the latent heat of evaporation L at constant pressure of any mixture of the two follows the proportionality law as indicated by the equation:

$$L = L_B x + L_A (1 - x)$$

where x is the composition in the component whose latent heat at that pressure is L_B , the latent heat of the other component being L_A . This equation implies that the heat required to evaporate a given amount of either component present in a mixture under a constant total pressure is the same as it would be in the pure condition at that pressure. If, in addition to this peculiarity, the mixture has the further property that its "total heat" when in the saturated vapor state equals the sum of the total heats that the components therein contained would have if each one were in the saturated condition at that pressure, the above equations are somewhat simplified.

Let J_A be the total heat per unit mass in the satu-

rated state of the more volatile component, and J_B that of the more condensible component. Then, if J is the total heat per unit mass of a mixed saturated vapor of composition x , the property just described is indicated by:

$$J = J_B x + J_A (1 - x)$$

Let I_A and I_B be the corresponding total heats of the pure constituents when each one is liquid at its boiling point. Then the two properties above described necessitate that the proportionality law holds also for the total heat I of a mixed liquid at its boiling point—i.e.,

$$I = I_B x + I_A (1 - x)$$

If, now, in the equation we have obtained between M_1 and M_2 , we substitute these expressions for the I 's and J 's, that equation becomes:

$$[(J_B - I_B)x + (J_A - I_A)(1 - x)] M_1 = [(J_B - I_B)x_2 + (J_A - I_A)(1 - x_2)] M_2$$

or

$$[L_B x_1 + L_A (1 - x_1)] M_1 = [L_B x_2 + L_A (1 - x_2)] M_2$$

The last equation may be obtained directly by writing, in place of the third of our original equations, one which states that for a mixture having the properties specified the heat required to vaporize the mass of the more volatile component evaporated in the column equals the heat lost by the mass of the more condensible component liquefied at the same time—i.e.,

$$L_B(x_2 M_2 - x_1 M_1) = L_A[(1 - y_1) m_1 - (1 - y_2) m_2]$$

This, if combined with the first two original equations, becomes:

$$[L_B x_1 + L_A (1 - x_1)] M_1 = [L_B x_2 + L_A (1 - x_2)] M_2$$

and solving for m_1 and m_2 , we have:

$$m_1 = \frac{x_2 - x_1}{y_2 - y_1} \frac{L_B y_2 + L_A (1 - y_2)}{L_B x_2 + L_A (1 - x_2)} M_1$$

$$m_2 = \frac{x_2 - x_1}{y_2 - y_1} \frac{L_B y_1 + L_A (1 - y_1)}{L_B x_2 + L_A (1 - x_2)} M_1$$

while the relation between x and y at an intermediate point in the column is:

$$\frac{x - x_1}{y - y_1} \frac{L_B y + L_A (1 - y)}{L_B x + L_A (1 - x)} = \frac{x_2 - x_1}{y_2 - y_1} \frac{L_B y_2 + L_A (1 - y_2)}{L_B x_2 + L_A (1 - x_2)}$$

or

$$\frac{x - x_1}{y - y_1} \frac{L_B y + L_A (1 - y)}{L_B x + L_A (1 - x)} = \frac{x_2 - x_1}{y_2 - y_1} \frac{L_B y_2 + L_A (1 - y_2)}{L_B x_2 + L_A (1 - x_2)}$$

SUMMARY

1. In the above discussion we have developed a set of relations applying to a simple adiabatic rectifier or to any section of an adiabatic rectifier in which no material is admitted or withdrawn at any level except the top and bottom.

2. We have pointed out the limitations necessary to be taken account of in estimating masses and compositions of products obtainable from given masses and compositions of materials entering such a rectifier.

3. We have developed a necessary relation between compositions of liquid and vapor in contact at any level in such a rectifier and have shown for what type of binary mixture "perfect" rectification under these conditions is possible.

4. We have obtained the special form these various relations take for a mixture having the property we have called proportionality latent heat at constant pressure.

To be continued in a subsequent issue.

The Tariff Act of 1922 and the Chemical Industries

An Eminent Economist's Views on the Development of American Manufacture of Dyestuffs and Chemicals and That Industry's Relation to the Tariff

In the last number of *The Quarterly Journal of Economics*, its editor, Prof. F. W. Taussig, contributes a comprehensive chapter on "The Tariff Act of 1922." The former chairman of the United States Tariff Commission has made a piercing analysis of the provisions of this measure, particularly in the relation they bear to economic developments in the industries affected by them. Dr. Taussig's views on the chemical schedule will be read with interest by those who have followed the development of the American chemical industry and its efforts to obtain protective legislation.

AMONG the most hotly debated paragraphs were those fixing the duties on coal-tar products and dyestuffs.

They were closely connected with the administrative provisions of the act. The history of this set of duties makes a long story, and the economic situation is highly complicated. Only a brief sketch is possible here.

THE WAR ARGUMENT

The war argument was used to the limit. Before 1914 the supply of dyestuffs, the most important of the coal-tar products, came almost exclusively from Germany. During the war there had been a great shortage, speculation, advances in prices, a hothouse domestic industry. At its close, the domestic producers were dismayed, and urged their case before Congress and the public with great insistence. On the other hand, the circumstances that there were large-scale combinations in the industry and that the unpopular du Pont concern was among the most important producers aroused suspicion and some hostility.

Regarded from the strictly economic point of view the industry does not seem to be adapted to American ways. In our technical parlance, it lacks a comparative advantage. Its processes are painfully detailed and elaborate, in which highly trained and highly paid labor is applied slowly and carefully to a variety of products. Each one of these products is turned out in small amounts; a possible exception is synthetic indigo, of which there is something like mass production. In the main it is adapted to the German industrial ways and traditions: exact applied science; patient experimenting; a technical staff and its trained technical assistants, to be had at comparatively low salaries and wages; large-scale operations but not mass production.

Some bad things have been said of the tricks of the German dyestuffs producers and merchants, and of the unscrupulousness of their competition. Apparently much of this was true, but hardly more true than of the same industry elsewhere; the business seems to lend itself to the worst features of the competitive system. The United States had not failed before the war to develop some chemical industries without high protection, but these were of a different type from the higher grades of coal-tar products. Here as in other directions the successful American industries are those turning out great quantities of a single product by large-scale methods. My impression is that not lack of aptitude for chemical industries as such, not great scarcity of trained chemists or lack of ability on their part, but the character of the dyestuffs part of the industry mainly explains the pre-war situation. As a matter

of the international division of labor, the people of the United States probably would do well to turn to other things in which they work to better advantage, and get their dyestuffs from Germany. And—to go on with the purely economic aspects of the case—the war stoppage of supply raises the old question whether it is worth while to restrict the advantages of the international division of labor because of a possibility of its sudden disruption.

But quite a different phase of the war argument was urged in this case. The cool economic considerations, not of a sort to receive attention under any circumstances from the dominant party, were quite disregarded because of the stress laid on the chemical industries, and especially on the manufacture of coal-tar products, for the direct service of war. The same plant can be used for making dyestuffs and the like in time of peace, for explosives and for poison gas when war comes. The line of reasoning is similar to that applied in favor of subsidizing a merchant marine: the ships can be used for the ordinary purposes of transportation during peace and can serve as an auxiliary navy or transport system in time of war. The plea is more dramatically effective as regards the coal-tar products: be prepared to make your own explosives and poison gas! It was pushed to the hilt; and in this case once more the general protectionist atmosphere caused it to be welcomed, with little endeavor to ascertain just how far the military needs went, whether each and every kind of coal-tar product had to be bolstered up at home in order to meet these needs.

GERMAN COMPETITION

On the other hand, domestic producers were so uncertain of their own position—so impossible was it to say just how much they had to fear from their dreaded German competitors—that they urged at first a complete prohibition, at least for a couple of years. In fact a virtual prohibition had existed since the close of the war through certain administrative regulations, and had been sanctioned by a temporary act of Congress. The proposal for the so-called embargo, however, proved unpopular, and though put in the bill as presented by the Ways and Means Committee to the House, was struck out by the House itself. After long debates in the Senate and with no little vacillation it finally was dropped from the act itself. In its place came some extremely high duties and some general administrative provisions which had no logical connection with the coal-tar products themselves but which nevertheless were expected or hoped to be applied to them.

The new rates of duty are extremely high. In 1916, when the war shortage of dyestuffs aroused attention, duties had been imposed upon dyestuffs of 30 per cent ad valorem plus 5 cents per pound. In the act of 1922 these rates become 40 per cent ad valorem (55 per cent until 1924) plus 7 cents per pound on the intermediate products and 45 per cent ad valorem (60 per cent until 1924) plus 7 cents per pound on the finished coal-tar dyes. The combination of specific and ad valorem duties is used, as it has been so often in the protective acts of recent years, to make sure that both the cheaper and the dearer forms shall be saddled with an effective high duty.

Much more important is the provision that these ad valorem rates shall be assessed, not under the ordinary procedure, but with "American valuation"; not on the basis of foreign market value, but on that of the

selling price in the United States of a similar article of domestic production. Of the controversy that centered about American valuation in general more will be said presently. It suffices here to point out that the effective duty is made very much higher by its application and that this special treatment is made obligatory for the coal-tar products, and for them only. Alone in the act they are thus singled out. There are further provisions for the proper labeling and description of these articles, and (elsewhere in the act) for the application of special restrictions for the prevention of the "unfair competition"; provisions which are entirely proper and should serve to meet a real need of combating unscrupulous competition. The rates themselves, to repeat, are extremely high. Both the industrial and the military conditions are so extraordinarily complex as to render the problem quite the most difficult I have encountered in the whole history of tariff legislation. But it is certain that the military excitement caused the protective policy to be applied more rigorously than would have been the case if these two factors had not combined, and more so than is justified by either if taken by itself.

Electron Emission From Thoriated Filaments*

Thoriated tungsten filament is a tungsten filament containing 1 or 2 per cent of thorium, usually in the form of oxide. When such a filament is heated to about 3,500 deg. C., a little of the thorium oxide is changed into metallic thorium. In the meantime, however, any thorium on the surface of the filament evaporates off, leaving only pure tungsten. If the filament temperature is then lowered to about 1,800 deg. C., the thorium gradually wanders or diffuses through the filament, and when it reaches the surface, if the vacuum is very perfect, remains there and gradually forms a layer of thorium atoms which never exceeds a single atom in thickness. The thickness of this film is therefore about 1/100,000,000 of an inch, and yet this film increases the electron emission of the filament more than 100,000 fold.

Of course this film is very sensitive and needs some protection to keep it in good condition. Very slight traces of water vapor or other gases would oxidize and destroy it. This can be avoided by putting in the bulb some substance that will combine with the water before this has a chance to attack the thorium film. Such a substance is metallic magnesium. Furthermore, it is necessary to avoid heating the filament to too high a temperature, for otherwise the film might evaporate off. It is therefore best to operate such filament within a rather narrow range of temperature close to 1,700 deg. C., where the ratio of evaporation is very small and where the temperature is high enough for the thorium gradually to diffuse to the surface and continually repair any damage done by the effect of slight traces of residual gases.

The thoriated tungsten filament opens up many new fields of scientific investigation. By measuring the electron currents, it is possible to determine accurately exactly how much thorium is present on the surface. An amount of thorium corresponding to only 1/1000 of the surface covered with a layer one atom deep is easily measurable in this way. It is possible to knock off a thorium film by bombarding it with positive ions, moving at high velocities, and in this way the true nature of this bombardment can be determined.

*Abstracted from a lecture by Dr. Irving Langmuir at Pittsburgh, Pa., Nov. 28, 1922.

The Magnetic Change A_2 In Silicon and Chromium Steels

By HOWARD SCOTT

Associate Physicist, Bureau of Standards

IF A carbon steel is magnetized under high magnetizing force, a marked loss in its magnetism occurs on heating through the temperature where eutectoid cementite goes into solution (A_c). In consequence, that transformation of the carbide and iron can be readily detected by magnetic methods such as have been effectively employed in the investigations of Honda and his associates of the Japanese Iron and Steel Research Institute, and outlined in this periodical, March 30, 1921. Commercial advantage is also taken of this phenomenon in some forms of hardening equipment designed to indicate when the steel has reached a hardening temperature by noting its loss of magnetism. However, A_c , the magnetic change in the ferrite of certain alloy steels, occurs below A_c . The method noted is then inapplicable. Since two important alloying elements in sufficient percentages causes this inversion in the position of the critical points A_c and A_c , it is intended to clarify the situation by presenting transformation temperature data on these alloy steels.

It was originally shown by Moore¹ that the magnetic change A_c occurs below A_c , the carbon point, in certain chromium steels, while Charpy and Cornu-Thenard² found the same to be true for high-silicon steels. The phenomenon has escaped general recognition due to the peculiarities inherent to the method of thermal analysis commonly used in steel testing laboratories. On the differential or time-temperature curves ordinarily recorded, A_c occurs as an indistinct bulge, lacking the easily recognized features it presents when the same data are plotted by the derived differential or inverse rate methods. To verify this, see the inverse rate heating curve for pure iron given at the left of Fig. 3. The fact is obvious enough when one considers that the inverse rate curves are of the same form as first derivatives of the differential curves.^{3,4} Therefore, a peak or maximum in an inverse rate curve corresponds to a point of maximum slope on the differential curve and this relation must of course be observed if the results from data plotted by one method are to be made comparable with those of the other.

A_2 IN CARBON STEELS

The maximum rate of thermal change identified with the magnetic change A_2 occurs at the same temperature in pure iron and in low-carbon steels, both on heating and on cooling. That is to say, $A_2 = A_c = A_r = 768$ deg. C. When determined by suitable thermal methods,

It Is Impossible to Rely Upon the Loss of Magnetism to Indicate Proper Hardening Temperatures for These Steels, Since the Carbon Change Point Is at a Higher Temperature Than the Magnetic Change Point

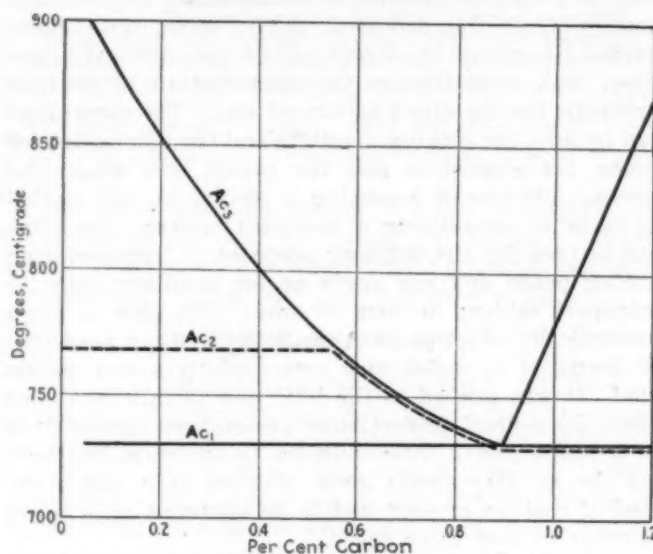


FIG. 1—THE TRANSFORMATIONS A_{c1} , A_{c2} AND A_{c3} OF PLAIN CARBON STEELS

it is quite sharp.⁵ The accompanying change of magnetization has, however, the peculiar property that it depends on the magnetizing force. With a low magnetizing force A_2 , as determined by magnetic methods is very abrupt,⁶ but when the magnetizing force is high and approaches saturation the steel begins to lose magnetism before reaching 600 deg. C., the loss continues with increasing rate upon further heating to 768 deg. C. and abruptly reaches a minimum just above this temperature. The temperature of the maximum rate of change of magnetism is, however, independent of the magnetizing force and corresponds to the temperature where the maximum amount of heat is evolved. Thus, notwithstanding the fact that loss of magnetism occurs over a considerable range of temperature, when suitable precautions are taken A_2 can be determined equally well by thermal or magnetic means, and the resulting data will agree.

Now when steels are heated, the pearlitic areas change into austenite at A_c . The ferrite plates which formerly existed in the pearlitic materials thus lose their identity, thereby losing whatever magnetism they possessed practically completely. But any excess ferrite left untransformed has the same unit magnetization as pure iron at the same temperature. The total magnetization remaining in low-carbon steels at any temperature between A_c and A_c is then roughly proportional to the amount of free ferrite present, providing the magnetizing force is high. (If the magnetizing force is low, only a very small part of the total change in magnetism occurs at A_c .) Thus, in

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¹Moore, *J. Iron and Steel Inst.*, vol. 81, p. 268 (1910).

²Charpy and Cornu-Thenard, *J. Iron and Steel Inst.*, vol. 1, (1915), p. 276.

³Bureau of Standards Scientific Paper 99.

⁴Russell, *J. Iron and Steel Inst.*, vol. 104, p. 261 (1921), plots curves of chromium steels which show the relationship between various methods of plotting.

⁵Burgess and Crowe, Bureau of Standards Scientific Paper 213.

⁶Smith and Guild, *Phil. Trans. Royal Soc.*, vol. 215, p. 177 (1915).

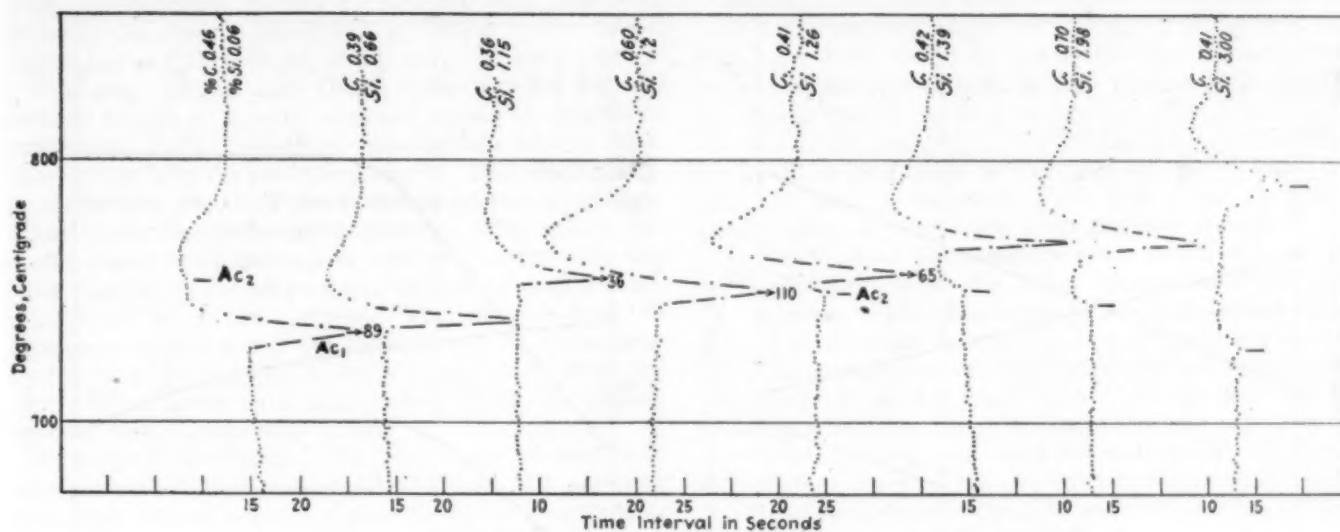


FIG. 2—INVERSE RATE HEATING CURVES OF SILICON STEELS

hypo-eutectoid steels the ferrite undissolved at Ac_1 gradually goes into the austenite solution as the temperature increases, so the total magnetization drops off from two causes—namely, the normal change of unit magnetization and the decrease in the amount of free ferrite through transformation to austenite. If carbon is so low that ferrite is not all dissolved when A_1 is reached, the remaining magnetism then disappears.

These facts regarding the temperature of disappearance of magnetism in steel are represented graphically by the broken line of Fig. 1, in which Ac_1 and Ac_2 are represented by solid lines. The horizontal for A_1 is deflected and continued just below Ac_1 , from 0.55 per cent carbon, where it meets Ac_1 , to 0.90 per cent carbon. For higher carbon contents Ac_2 is shown just below Ac_1 , to indicate that the temperature of disappearance of magnetism actually coincides with the change of pearlite into austenite.

In Table I are given the significant data on silicon and chromium steels taken from inverse rate thermal curves obtained by the method described in Bureau of Standards Scientific Paper 348, and in the American Institute Mining and Metallurgical Engineers' Pyrometry Volume, page 2140. Heating curves for silicon steels are reproduced in Fig. 2 and of chromium steels in Fig. 3, together with comparison curves of a pure iron and a straight carbon steel.

Transformation temperatures are plotted against per cent alloy in Fig. 4 for silicon steels and in Fig. 5 for chromium steels. A_1 plotted in these figures for zero alloy is 768 deg. C., the same as in low-carbon steels. For compositions in which it occurs above Ac_1 , the curve is broken; it is thus apparent that the magnet method for determining hardening heats is not directly applicable in silicon or chromium steels containing above 1 and 2½ per cent of alloy respectively.

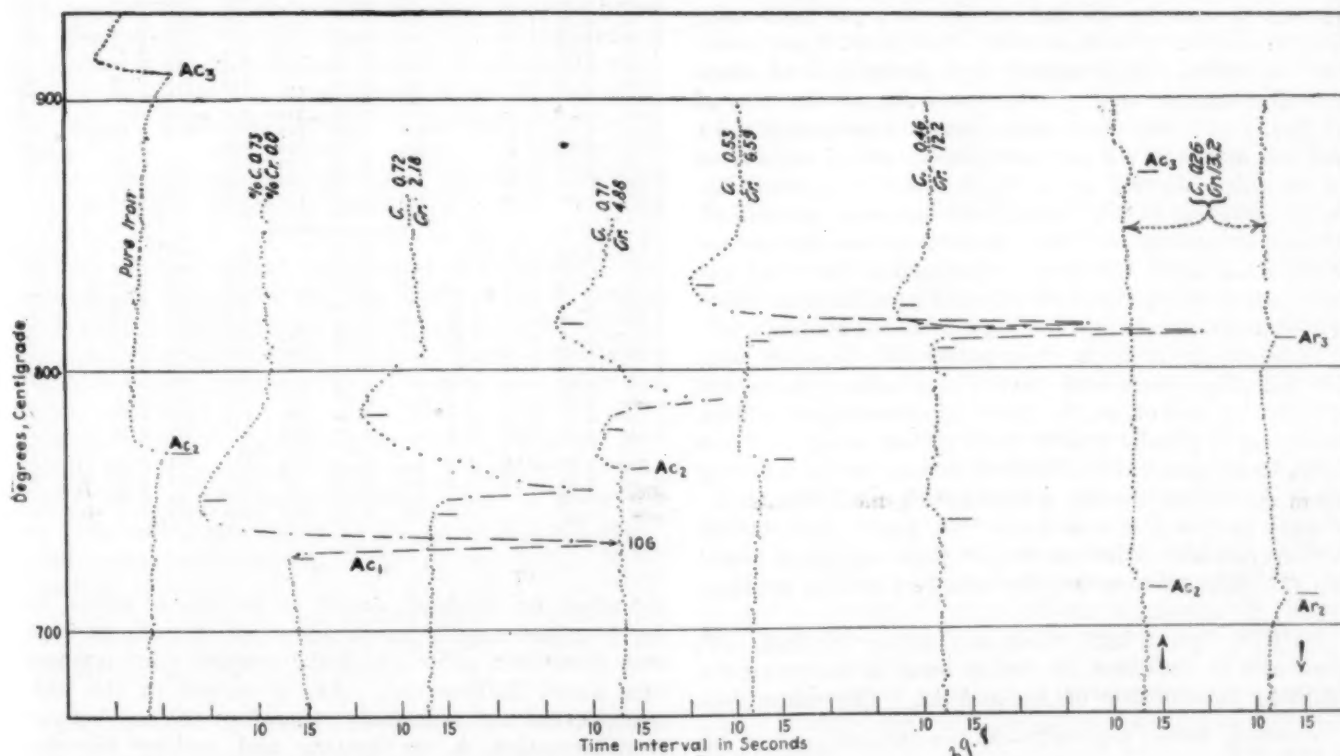


FIG. 3—INVERSE RATE HEATING CURVES OF CHROMIUM STEELS

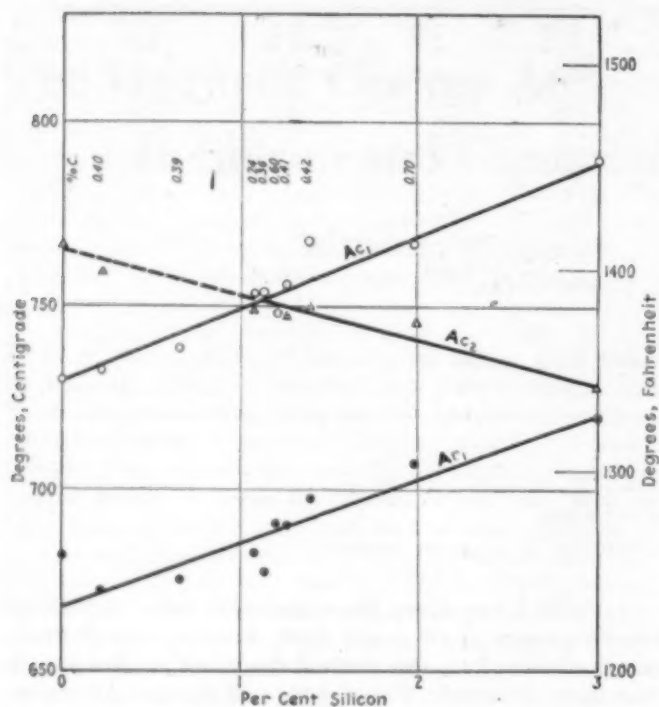


FIG. 4—THE EFFECT OF SILICON ON A_{c1} , A_{r1} , AND A_{c2} IN STEELS AVERAGING 0.45 PER CENT C AND 0.70 PER CENT Mn

Values of A_{c1} and A_{r1} for zero silicon on Fig. 4 were obtained by interpolation of data on pure iron-carbon manganese alloys to correspond to an analysis of 0.45 per cent C and 0.70 per cent Mn, the average of these elements in the silicon steels. For zero chromium in Fig. 5 are used the values for a carbon steel of near the average carbon and manganese contents of the chromium steels, 0.75 per cent and 0.45 per cent respectively. Curves are drawn to represent the average carbon contents.

The principal effects of silicon are (1) to raise A_{c1} 21 deg. C. and A_{r1} 18 deg. C. for each per cent addition of silicon up to a content of at least 3 per cent; (2) to reduce the intensity and abruptness of these transformations; and (3) to lower A_{c1} at the rate of 21 deg. C. for each per cent silicon. Consequently A_{c1} and A_{c2} merge at 1.2 per cent silicon, and if the curves be extended above 3 per cent, A_{c1} would also cross A_{r1} . A_{c1} is lowered at the same rate in pure iron-silicon alloys, according to the magnetic observations of Murakami,¹ until 450 deg. C. is reached for a 17 per cent silicon alloy, the limit of solid solubility, at which temperature it remains for higher silicon contents.

Since there is such close agreement between commercial alloy steels and pure Fe:Si alloys, A_{c1} is not affected by carbon in the form of cementite in silicon steels (as is equally true in plain carbon steels). These facts do not mean that dissolved carbon has no influence upon A_{c1} unless there is a change of solubility at A_{c1} . Moore² proves there is not. We know that carbon content has little effect on A_{c1} , so these curves of Fig. 4 are probably reliable for the range of carbon contents found in commercial steels.

Data on chromium steels are rather limited, but show clearly the effect of that element in reversing the ordinary relationship of A_{c1} and A_{c2} . Chromium does

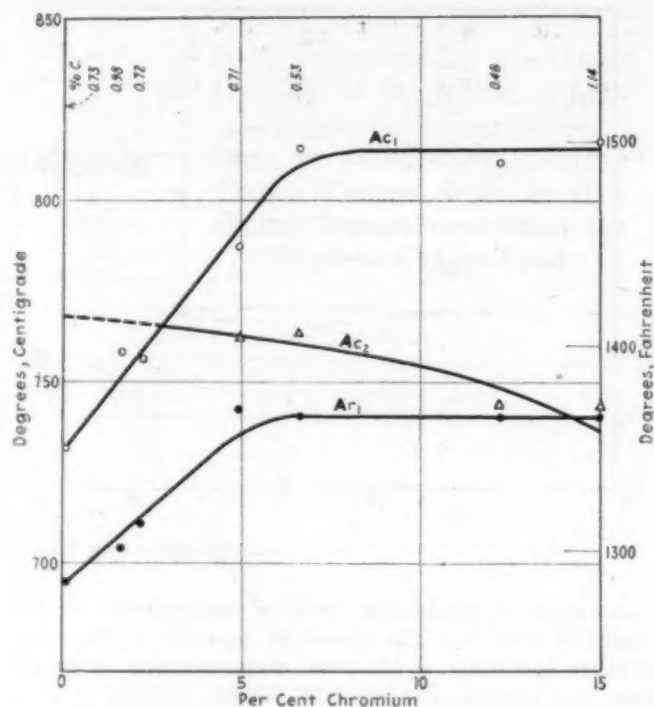


FIG. 5—THE EFFECT OF CHROMIUM ON A_{c1} , A_{r1} AND A_{c2} IN STEELS AVERAGING 0.75 PER CENT C AND 0.45 PER CENT Mn

TABLE 1—TRANSFORMATION DATA FROM INVERSE RATE CURVES OF SILICON AND CHROMIUM STEELS.

Composition				Heating Rate of Heat- ing, Deg. C. Per Sec.	A_{c2} Maximum, Deg. C.	A_{c1} Maximum, Deg. C.	Maximum Temp. of Heating Deg. C.	Rate of Cooling, Deg. C. per Sec.	A_{r2} Maximum, Deg. C.	A_{r1} Maximum, Deg. C.
Per Cent C	Per Cent Mn.	Per Cent Si	Per Cent Cr							
Silicon Steels										
0.40	0.75	0.22	....	....	0.16	759(?)	732	880	0.14	672
0.39	0.58	0.66	....	1st.	0.19	...	736	910	0.18	673
0.39	0.58	0.66	....	2nd.	0.15	...	740	840	0.14	678
0.24	0.71	1.08	....	2nd.	0.09	...	754	960	0.10	748
0.24	0.71	1.08	....	3rd.	0.10	...	754	960	0.11	750
0.36	0.65	1.15	....	1st.	0.27	...	756	940	0.24	676
0.36	0.65	1.15	....	2nd.	0.19	...	752	910	0.16	678
0.60	0.74	1.2	....	1st.	0.08	...	748	910	0.08	690
0.41	0.74	1.26	....	1st.	0.08	749	755	915	0.09	692
0.41	0.74	1.26	....	2nd.	0.15	743	754	915	0.15	683
0.41	0.74	1.26	....	3rd.	0.10	748	758	915	0.09	696
0.42	0.85	1.39	....	1st.	0.26	751	769	...	0.23	698
0.42	0.85	1.39	....	2nd.	0.16	750	767	925	0.14	696
0.70	0.41	1.98	....	1st.	0.15	746	767	875	0.15	707
0.41	0.86	3.00	....	1st.	0.16	727	790	920	0.15	719
Chromium Steels										
0.73	0.38	0.01	0.0	....	0.12	...	731	875	0.14	694
0.98	0.32	0.65	1.60	1st.	0.25	...	760	965	0.24	702
0.98	0.32	0.65	1.60	2nd.	0.21	...	756	905	0.19	706
0.72*	0.49	0.19	2.18	1st.	0.14	...	753	865	0.15	712
0.72*	0.49	0.19	2.18	1st.	0.13	...	760	870	0.13	709
0.71*	0.34	0.37	4.88	1st.	0.14	762	787	875	0.15	742
0.53	0.70	0.44	6.59	1st.	0.17	764	816	965	0.15	720
0.53	0.70	0.44	6.59	2nd.	0.16	765	812	1,070	0.15	740
0.46	0.67	0.13	12.2	1st.	0.13	745	807	915	0.13	740
0.47	0.67	0.13	12.2	2nd.	0.17	742	812	1,045	0.15	742
1.14*	0.32	0.25	15.0	1st.	0.14	751	816	905	0.15	742
1.14*	0.32	0.25	15.0	1st.	0.13	735	815	905	0.14	737
0.26*	0.85	0.70	13.2	1st.	0.15	714	871	915	0.17	809
0.26*	0.85	0.70	13.2	1st.	0.16	711	879	925	0.15	805
0.36	0.38	....	15.8	1st.	0.12	718	852	905	0.12	774
0.36	0.38	....	15.8	2nd.	0.12	717	853	905	0.12	804

* Previously hardened. † A_{r1} = 680, A_{r2} = 294. ‡ A_{r1} = 700, A_{r2} = 381

not affect A_{c1} markedly except in the higher alloys, but A_{c1} is raised rapidly up to about 810 deg. C. at 7 per cent chromium, after which the concentration-temperature curve flattens out. A_{r1} is raised in the same manner, but not as rapidly; therefore the lag between transformation A_{c1} on heating and cooling increases

¹Murakami, Science Reports Tohoku Imperial Univ., vol. 10, No. 2, May, 1921.

with the chromium content up to 7 per cent. The rate at which A_c rises is about half as fast as in the silicon steels, and A_c crosses A_s at 2.5 per cent chromium.

Edwards, Sutton and Oishi² have determined the critical ranges of a very complete series of chromium steels, but their values are considerably higher than those given here for equivalent steels. This discrepancy is probably a result of their method of recording data taken from the differential curves. The values for steels within their series are, however, comparable and show that A_c is not affected appreciably by considerable differences in carbon content. The same is true of the observations noted by Russell¹ and of those presented here for carbon contents above about 0.40 per cent. When lower carbon-chromium steels are studied another factor apparently enters.

Data given in Table I for two steels of less than 0.40 per cent C and containing 13.2 and 15.8 per cent chromium respectively show that the upper transformations of these steels occur at a much higher temperature than in similar steels of slightly higher carbon content. The last two curves shown in Fig. 4 are heating and cooling curves of one of these steels. The high temperature, the marked diminution of intensity and the change in shape of the inflections indicate that the transformation involved is A_s rather than A_c . This suggests that carbon up to about 0.40 per cent is soluble in ferrite containing high chromium, but there are insufficient data available to verify this. It is, however, significant that Monypenny³ finds the solubility of carbon in austenite to be greatly decreased by chromium. In consequence, chromium steels containing over about 0.40 per cent carbon and 12 per cent chromium are hypereutectoid, and A_s only is observed on thermal analysis.

SUMMARY

From a discussion of thermal and magnetization curves, it is noted that $A_s = A_c = A_r$ is a continuous change in the magnetization of ferrite reaching a maximum rate of change at 768 deg. C., just below the temperature of total disappearance of magnetism. In carbon steels this change differs from that in pure iron in degree only, a circumstance which is caused by the transformation of ferrite to austenite within its range.

The critical temperatures A_c , A_r , and A_s are modified in the following manner:

A_c is raised 21 deg. C. and A_r is raised 18 deg. C. for each per cent silicon added up to at least 3 per cent, while A_s is lowered 21 deg. C. for the same increment.

Chromium raises A_c 11 deg. C. and A_r 6 deg. C. for each per cent addition up to about 7 per cent, above which they are stationary, but it lowers A_s only in the higher percentages.

Chromium steels containing in excess of 0.40 per cent carbon and 12 per cent chromium are hypereutectoid.

A_c occurs below A_s for silicon contents above 1.2 per cent and chromium contents above 2.5 per cent.

When A_c occurs below A_s , the latter change is not detectible by the usual magnetic methods and so equipment depending on the loss of magnetism for indicating the proper hardening temperature cannot function for high silicon and chromium steels.

Recent Experiments on Chlorine Volatilization

Experiments were made at Bureau of Mines station, Salt Lake City, Utah, on some lead-zinc concentrates for the Kirk-Simon Smelting Co., Harbor City, Calif., in an endeavor to make a separation of lead and zinc. The procedure consists of separating part of the lead as the oxide and part as chloride by the addition of salt, and then a reducing agent was added to make a good grade of zinc oxide from the zinc residue.

Following some volatilization experiments carried on in co-operation with the Chief Consolidated Mining Co., Eureka, Utah, this company erected a semi-commercial plant which includes horizontal Cottrell treaters and a three-compartment bag-house. It was found that treatment of pulped fume with milk of lime would make an acceptable product, containing the values in a concentrated form, and could be sold to the smelters. Experiments made on the electrolytic treatment of fume in a fused bath showed excellent recoveries of the silver, with a good current efficiency.

RECOVERY OF SILVER, LEAD AND COPPER

A good deal of work has been done to determine why it was more difficult to volatilize silver than lead when the two were present in the same ore. It was found that silver chloride formed readily and was quite stable under furnace conditions, but that it required considerable time at high temperature to volatilize even after it was formed. Aeration of the charge reduces this time materially. Vapor pressure of $AgCl$ is low at 1,000 deg.

After testing a variety of ores and looking over former work it seems that the best field for the immediate utilization of the volatilization process lies in lead-zinc separation. It was also found that most of the lead could be separated from the zinc as lead oxide, and many fields for oxide volatilization are now being opened. A good zinc concentrate can be made from many ores which are at the present time too high in lead to have much commercial value, and at the same time the sulphur can be eliminated to save freight.

CHEMISTRY OF THE VOLATILIZATION PROCESS

During the past fiscal year an effort was made by the Bureau of Mines to get some valid fundamental data upon which might be based the chloride volatilization work. Up to this time this work has been divided into four principal divisions: (a) A study of the effect of elemental chloride on a zinc carbonate ore. (b) Various theoretical calculations of vapor pressure, heats and reactions, and various predictions as to courses of reactions and applicability of various metallic chlorides as chloridizing agents. (c) Direct measurement, by a static method, of the vapor pressure of various metallic chlorides. (d) The measurement of equilibria in systems consisting of a metallic oxide, metallic chloride, oxygen and chlorine.

Zinc Condensers

In large-scale experiments with the distillation of zinc by the electric current, difficulty has been encountered in the fact that condenser linings made from ordinary refractories break down due to carbon deposition around particles of iron oxide contained in the refractory material. Small-scale experiments are being carried on at the Rolla station of the Bureau of Mines using condensers lined with various iron-free refractories to determine what materials are permissible for this purpose.

¹Edwards, Sutton and Oishi, *J. Iron and Steel Inst.*, vol. 101, p. 403 (1920).

²Monypenny, *J. Iron and Steel Inst.*, vol. 101, p. 493 (1920).

Pyrex Glass as a Material for Chemical Plant Construction*

By A. E. MARSHALL

Consulting Chemical Engineer, Baltimore, Md.

Boro-Silicate Glass Has Already Established a Unique Place for Itself in Chemical Industries and the Possibilities Are Tremendous—Less Than a Year Ago Industrial Pyrex Was Undertaken Seriously—The Progress Made Is Reported in This Paper

ANYONE who has undertaken construction work on chemical plants, whether for the manufacture of mineral acids or less corrosive products, will admit that no available material gives satisfactory service under all conditions.

Materials in general use have specific advantages for specific work, and the chemical engineer utilizes a number of different materials in one piece of construction in order to develop maximum durability under varying conditions. Incidentally, durability is in many cases synonymous with resistance to corrosion.

Glass, because of its insolubility in acids, has always found uses in the chemical industry, but its limitations in the way of temperature resistance have restricted the field of application.

LIMITED USE OF ORDINARY GLASS IN INDUSTRY

Ordinary glass, if desired to withstand moderate temperature changes, has to be made into shapes with thin walls, and such shapes when thin enough to survive slight heat shocks are much too thin to stand up under ordinary plant usage, or in many cases to survive rough handling during erection.

The desire to make use of the non-corrosive properties of glass has led to its being tried out under a variety of plant operating conditions, but the inherent disadvantages of ordinary glasses so far outweigh the useful features that it is difficult to point to successful applications in plant-scale work except under special circumstances.

I remember making a survey some years ago of materials used in the construction of gas-conveying lines from hydrochloric acid pots and muffles. One plant at the time of my visit was using 15-in. slip joint glass pipes on the pot line. Very good results were being obtained because of the thorough cooling of the gas in its passage through the thin-walled pipes to the absorption tower. Later inquiries indicated rather heavy breakage during the winter months, the cause being ascribed to leakage of melted snow through the roof and onto the pipes, or to the considerable difference in temperature between the atmosphere and the gas inside the pipes.

There was a purely local reason for the use of glass on this line. The chemical plant adjoined a glass factory, and the glass pipes were thin cylinders from the plate glass department.

When wire glass was introduced it seemed to offer decided possibilities to the chemical industry, and it was tried out for various uses without any great measure of success. I was very much interested in sulphuric acid concentrators at that time, and I substituted some wire glass plates for the acid-proof cover slabs on a cascade concentrator. The glass cracked in the course of a few hours and thereafter final collapse was merely

dependent on the time required for the acid fume to attack the wire reinforcement.

Other engineers have endeavored to utilize glass in various ways, and where temperature resistance and mechanical strength have not been essential, the material has proved satisfactory. I have in mind, as an instance, the glass-packed Gay-Lussac and absorption towers introduced in England about 1909 by Carmichael. These towers, usually of square section, are packed with annealed plate glass sheets, set on edge and spaced fairly closely. Each successive layer of packing is placed at right angles to the row below, thus giving excellent surface contact and good gas distribution.

Mention has been made of attempts to use, and the actual use of, ordinary glass in plant construction, because such attempts afford evidence of a desire on the part of the chemical industry to utilize the valuable non-corrosive properties of glass.

INDUSTRIAL POSSIBILITIES OF PYREX REALIZED IN LABORATORY WARE

With the introduction of Pyrex as a laboratory material and as a domestic utility in the form of baking ware, the possibilities of using glass in plant construction assumed a more promising outlook. Chemical manufacturers tried out Pyrex baking ware for small-scale chemical operations, drawn Pyrex tubes were used in Hart nitric acid condensers, and many other minor uses were discovered for the standard shapes which were being produced for the laboratory or the home.

In December of last year the author suggested to the Corning Glass Works the desirability of gathering together these sporadic developments and investigating the possibilities of producing a line of Pyrex products designed for the use of the chemical industry. The field appeared promising, and a decision was reached to establish an industrial Pyrex department, the author being retained as consulting engineer.

Before entering into a description of the present state of development, it is necessary to set forth the essential characteristics of Pyrex and the difference in its properties and ordinary glass.

WHAT PYREX IS

Pyrex is a low-expansion boro-silicate glass of simple chemical composition, containing no metals of the magnesia-lime-zinc group and no heavy metals.

A comparison of the linear expansion coefficients of Pyrex and a number of materials is given in Table I and, as will be seen, Pyrex has a smaller coefficient than porcelain, ordinary glass or any of the usual metals.

The low coefficient of expansion introduces a marked distinction from ordinary glass whether of the lead or lime-soda type.

*Paper presented at the Richmond meeting of the American Institute of Chemical Engineers, Dec. 8, 1922.

TABLE I—LINEAR EXPANSION COEFFICIENTS
(PER DEG. C.)

Pyrex glass	0.0000032
Porcelain	0.0000036
Hard glass	0.0000077
Soft glass	0.0000085
Cast iron	0.0000102
Wrought iron	0.0000119
Portland cement	0.0000120
Copper	0.0000167
Brass (66Cu-34Zn)	0.0000190
Zinc	0.0000258
Lead	0.0000276

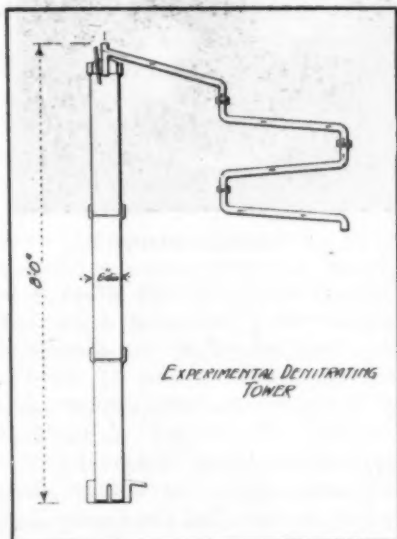
The melting point of glass is not particularly valuable as an engineering consideration, as there is usually a fairly wide range between the initial softening point and final melting point. In the case of Pyrex, the softening point is about 800 deg. C., but the material will soften slightly, especially under pressure, if maintained for a long time above 600 deg. C.

In connection with the softening point it is useful to remember that devitrification, which is a serious factor in the use of some materials, does not affect Pyrex in its working range.

COMPARATIVE ACID RESISTANCE OF GLASSES

Acid resistance is not usually given much thought in the case of glass, the general assumption being that all glasses are equally resistant. Bulletin 107 of the Bureau of Standards gives considerable data on the acid-resisting qualities of Pyrex and other glasses, and is well worth study. Researches have also been conducted in the Corning laboratories on the resistance of Pyrex to perchloric, phosphoric, constant boiling hydrochloric and concentrated sulphuric acids under a variety of conditions.

The action of hydrochloric and sulphuric acid is very slight, constant boiling hydrochloric acid attacking Pyrex at a rate of 0.000006 gram per square centimeter per hour. Concentrated sulphuric acid in 4 hours at the fuming temperature shows an attack of 0.000002 gram per square centimeter per hour. Both figures



INSTALLED BY THE DU PONT CO.

relate to initial surface attack, as after the lapse of a few hours a state of practical stability is reached.

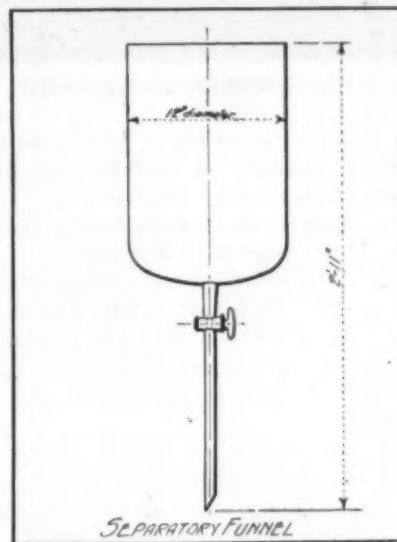
Work on the coefficient of heat transference is being carried out at Corning, but has not been completed. Preliminary results on the relative efficiencies of Pyrex, porcelain and stoneware indicate Pyrex and porcelain

as equal, whereas stoneware shows about one-half the Pyrex value.

It can be said that while Pyrex is superficially a glass, its physical characteristics justify consideration from the engineering standpoint as a special and distinct material adapted to a variety of industrial uses to which ordinary glass cannot be applied.

THE DEVELOPMENT OF INDUSTRIAL SHAPES

Proceeding from a consideration of useful properties to the development of definite industrial shapes, it is obvious that the upper limit of size is a factor of great



ONE OF THE FIRST PIECES OF PYREX INDUSTRIAL EQUIPMENT

importance. If the sizes had to be restricted below the usual standards in other materials, then the field of application would also be restricted. It was not practicable to pick out very large pieces and concentrate on them, for the reason that failure in manufacture might be caused by lack of dexterity in handling such large shapes. The history of most plant materials, stoneware, fused silica, high-silicon irons, etc., has been one of gradual enlargement of product. In the case of Pyrex the existing laboratory and domestic shapes could be used as a starting point and a stage selected which would represent useful commercial products without going out to sizes which would call for the introduction of new methods of handling.

The starting points selected were therefore an 18-in. evaporating dish, a 6-in. bore socket pipe 39 in. over all, and a cylindrical pot 12 in. in diameter by 20 in. high.

It was expected that difficulties would develop in the manufacturing process; but contrary to expectations, production was worked out with nothing more than the usual minor troubles.

With proof that manufacture was possible, it was then necessary to test out the product under working conditions. These tests were made on single pieces in various plants, and following satisfactory reports, distribution was started on a small scale.

The application of these first available shapes brought along a demand for other forms of Pyrex equipment, and as a consequence new items have been added in the last few months, while others are approaching the production stage.

Reference is directed to the 72-liter capacity retorts, designed for distillation and reaction work, various



PYREX DISH, 25 IN. DIAMETER AND 30 LITERS CAPACITY

sizes of pots up to 9-gal. capacity, and large separatory funnels of 8-gal. capacity as articles now available.

Pyrex glass is also being produced in sheets 14x18 in., and it is expected that much larger sheets can be made if there is the necessary demand.

In addition to the above items a 25-in. diameter dish of 30-liter capacity is about ready for distribution, 12-in. socket pipes will follow in a few weeks, and other shapes of equivalent size, such as a drier tray, cascade dishes, etc., will be put in production as soon as a demand is assured.

Incidentally the use of Pyrex in forms developed especially for the chemical industry has created interest in the possibilities of equipment made from Pyrex tubing. Condensing equipment made up of "S" bends, pipe lines with socket or butt joints, and many similar uses are becoming standardized.

A PYREX DENITRATING TOWER

An interesting piece of Pyrex equipment was constructed recently for the du Pont company. This was in the form of an experimental denitrating tower 6 in. in diameter by 8 ft. high. All parts, including distributor, inlet and outlet connections, were Pyrex. It is understood that the tower has given satisfactory service, despite rather strenuous conditions.

The use of Pyrex in actual plant work has developed some interesting sidelights, not only on applications but on a phase of excessive cost, created by a lack of standardization. This point will be discussed later.

It had been expected by users that there would be a higher handling breakage with Pyrex dishes than with porcelain. Experience has been entirely to the contrary, and the reason apparently lies in the province of psychology. One plant, which is now completely equipped with Pyrex dishes, reports handling breakages as nil, and states that the men treat the dishes as glass, setting them down with care and so obviating breakages through dropping. It has been the experience of every user of Pyrex, irrespective of the shape of the article, that transparency creates care in handling. It is a natural assumption that an opaque object will withstand shocks and that a transparent one will not, so a transparent material which is at least equal to stoneware and porcelain in mechanical strength has a much better chance to survive at the hands of a workman. Transparency has other advantages which are not psychological. The first and most important is that a transparent article cannot have blowholes or other hidden flaws. Even strains can be detected by the use of a special polariscope, this being one of the

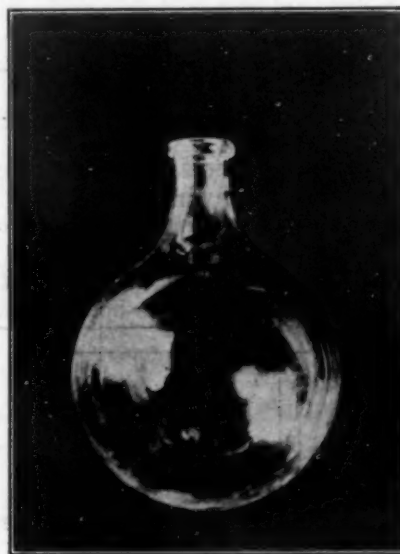
routine tests to which every piece of Pyrex equipment is subjected in the Corning factory.

Next comes the question of cleanliness. Opaque equipment may or may not be clean, but transparent equipment always supplies its own positive answer on this point. Finally there is the feature of controlling reactions through direct observation.

ADVANTAGE OF RAPID PROCESS OF FABRICATION

Another interesting feature which has been brought forward by users is in relation to the process of manufacture. Pyrex is to a certain extent competitive with chemical stoneware. The process of making stoneware is quite lengthy, the time required being about 2 months. Breakage of a special piece of stoneware, provided there is no duplicate in the plant store room or at the stoneware manufacturer's works, means a long delay in starting up after the shut-down. Providing a mold exists for the piece in Pyrex, manufacture can be completed in 3 days as a minimum, although factory conditions might necessitate a delay of a few additional days on account of prior routing of work.

Touching on the phase of excess costs of construction materials, it seems very desirable to emphasize the lack of standardization in the chemical industry. Molds are costly, whether they are intended for stoneware, silica, Pyrex or other materials. The manufacturer of the equipment has to charge up his mold cost to the



A 72-LITER RETORT

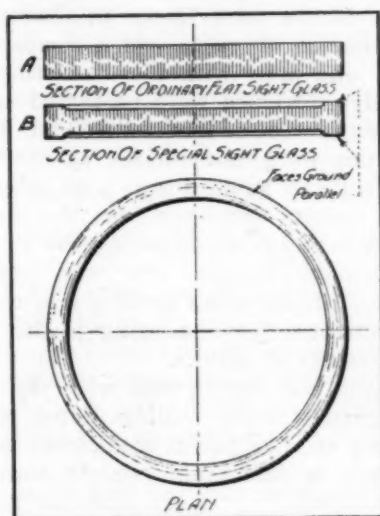
user, and there seems to be too great a demand for "specials"—which may vary only $\frac{1}{8}$ in. from a stock mold. Some concerted effort to standardize shapes would cheapen the products, and, of equal importance, would enable producers to carry representative stocks. A striking example of the lack of standardization is shown by the Corning Glass Works list of sight glass molds. Continuous efforts have been made to keep down the number of sizes, but the success can be judged when it is shown that between the range of $2\frac{1}{2}$ in. diameter by $\frac{1}{4}$ in. thickness to $8\frac{1}{2}$ in. it has been necessary to provide forty-one molds.

In the case of plant equipment, a further effort is being made to work out shapes which will suit a variety of uses, and it is hoped that a full measure of co-operation will be extended by plant managers and engineers, through the use of stock rather than special molds.

The industrial use of Pyrex is spreading into many fields, and while not a strictly chemical application, decided interest attaches to the development by the research laboratories of the Corning Glass Works of Pyrex high-tension insulators.

The generally accepted causes of failure of porcelain high-tension insulators are: (1) change in structure of porcelain with time and absorption of moisture; (2) breakage due to thermal changes; (3) flaws in the porcelain body, causing dielectric and other failures; (4) failure due to expansion of cements used in attaching hardware to the insulator; (5) mechanical weakness. These failures may be generally classified as failure due to the properties of the insulator and failure due to design.

Pyrex glass seems to have ideal properties for an insulator, for it apparently is not subject to any of the intrinsic weaknesses of the porcelain insulator. It



SUGGESTED DESIGN OF PYREX SIGHT GLASS

does not change in structure, can be inspected for any defects, thus assuring a uniform product, has a sufficiently high dielectric strength, a great resistance to thermal changes (its thermal expansion coefficient being lower than that of porcelain) and in addition is not heated by direct solar radiation as much as porcelain. Consequently if a Pyrex glass insulator could be built free from the design defects of the porcelain, there is no question that it would be a better insulator.

Fig. 1 shows the construction of the Pyrex insulator. It is evident at a glance that this construction and design gives a cement-free, all-metal and glass insulator and that the design is one of great resistance to tension, as the material of the insulator is largely under compression.

Considerable data have been collected showing the relative properties of Pyrex.

Heating of glass and porcelain insulators by solar radiation shows a rise in temperature above air temperature for a porcelain insulator of 39.5 deg. C., and for a Pyrex insulator of 10.8 deg. C. This is a mean of ten observations in both cases. These data show the increase in temperature due to solar radiation to be 3.65 times as much for the porcelain as it is for the glass. The glass is transparent and the porcelain absorbs the heat radiation. This proves that in service the glass is not subjected to anything like as severe heat changes as porcelain.

In a report on dielectric strength tests made by one

of the large manufacturers of electrical equipment it was stated that unit No. 1 punctured at 143 kilovolts, unit No. 2 punctured at 160 kilovolts, and unit No. 3 punctured at 140 kilovolts.

"The tests on Pyrex suspension insulators show quite conclusively that the material has good characteristics. The uniformity of electrical puncture is a distinct advantage over porcelain."

It is evident that Pyrex glass has very good dielectric properties, more than ample for the service, as well as being uniform.

Tensile strength tests made by Cornell University, Sibley College, show:

No. 1.	22,600 lb.	.....	No break
No. 2.	23,000 lb.	.....	Pin broke in holding device
No. 3.	19,500 lb.	.....	Pin broke in holding device, reaction broke insulator
No. 4.	22,750 lb.	.....	Yielding, no break
No. 5.	23,600 lb.	.....	Cracked
No. 6.	20,600 lb.	.....	Click, no break
No. 7.	21,800 lb.	.....	Click, cracked
No. 8.	22,000 lb.	.....	No break
No. 9.	17,000 lb.	.....	Click
No. 10.	22,500 lb.	.....	Click again, cracked
	25,460 lb.	.....	Broke stud, flange shattered by reaction, head O. K.

Since the better grades of porcelain insulators will not stand over 10,000 lb. load as a maximum, and many break below that, it is evident that the glass insulator has a strength far superior to anything yet developed. This property should allow for longer spans, and in many cases where two strings of porcelain are used in parallel one of Pyrex will be ample to carry the load.

Pyrex glass has a great resistance to water absorption and surface attack, and is therefore durable under long exposures to severe atmospheric conditions, as for instance around chemical plants.

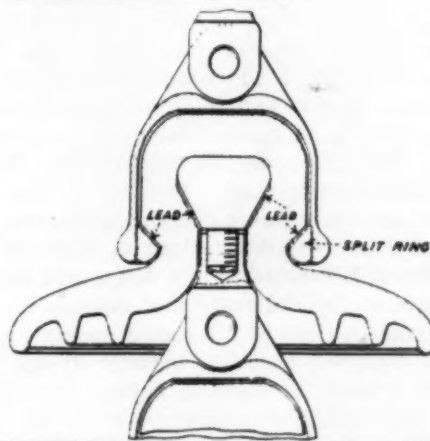


FIG. 1—DIAGRAM OF PYREX INSULATOR

It is probable that glass insulators will not be as attractive to birds and spiders for nesting sites, since they will not have the dark shadows that exist in a string of porcelain insulators.

The chief advantages of the Pyrex insulator are the fact that it does not absorb heat as does porcelain; has no cement in its construction gradually to absorb water and expand, ultimately fracturing the insulator; and has a mechanical strength that will average twice as high as any porcelain insulator yet on the market.

This paper describes in sufficient detail the present status of industrial Pyrex, and carries a suggestion of future possibilities. It is believed that Pyrex will in a short time occupy a definite place along with the other materials used for plant construction. It is not a universal panacea for construction ills, but, like everything else in our practice, it demands thought in its application and care in its use.

European Conditions as I Saw Them*

Deplorable Policy of Feeding the German Masses With Propaganda of Hatred Toward Former Enemies, Particularly the French—Salvation of Germany Depends on Payment of Honest Wages and Sale of German Products at Prices Commensurate With Their Intrinsic Value

BY J. S. NEGRU

AS I now pass in review my impressions gained in Germany during my visit there during the summer of 1922, I am compelled to say that the worst which has befallen the German people is not the loss of the war, but the policy of a handful of Germans who keep the remainder of their countrymen practically in complete ignorance of what the outside world has learned about Germany's doings during and after the war.

Although throughout the war, the Germans employed means which alienated for them the consideration which is due to a civilized people, even to this day they know only about their own sufferings and privations, and seem not to have the least idea or thought of what was and is going on elsewhere. Since the war they have been led to believe that the conditions which have been imposed upon them were not imposed as a means to alleviate conditions caused by their acts during the war, but as a concerted plan to destroy them as a people.

For this state of mind, a handful of Germans is responsible. They are the leading industrialists of the country, who grew immensely rich during the war, and after the war dreamed of mastering the world's markets. This they have done by feeding the people systematically with hatred propaganda, at the same time compelling them to work for ridiculously low prices and selling for export German products requiring large amounts of manual labor at far below their real value. This procedure did not have the effect which the industrialists expected. Instead, it has resulted in Germany gradually falling in the estimation of other nations, and has created a feeling of distrust which it may take her generations to live down, and thus regain her lost place in the community of nations.

While I was in Germany I stated openly my impressions, as I received them, to practically all Germans with whom I came in contact, hoping by this means, if I were mistaken, to compel them to tell me facts which might lead to nullifying or modifying those impressions. Therefore, the judgment at which I arrived as to actual conditions in Germany is free from any personal bias.

PRIDE IN GERMANY BEFORE THE WAR

Germany before the war was strong and boastfully conscious of her strength. There was then no visible hatred toward any foreign nation, foreigners were treated with the consideration due to visitors. Her cities were well patrolled and everything was minutely regulated according to the "verboten" dogmas. Her railways were considered the best in the world as to regularity of traffic. She pointed to her intellectuals with almost as much pride as she did to her uniformed defenders of the Vaterland. The results of her re-

searches were made public freely and served as steps in the advancement of human knowledge. Her scientific and technical magazines and books were standard, sought for and studied by all who wished to attain recognition as savants. The degree of Doctor obtained in German schools and German universities was the open sesame to the fraternity of the learned. The German students were the coming leaders and were aware of their importance. Her factories were busy and the workmen imbued with the spirit of the then real meaning of the label "Made in Germany," which was the production of goods which competed honestly as to quality and price with those of other industrial countries. Her workmen were contented and received what was considered a fair return for their labor. Business ethics were summarized in the term "Ein Mann ein Wort" (a man's word). In brief, Germany was a great country, but even then she was suffering from an illness which accompanies the exalted belief in self-importance—namely, she was conceited and became so to such an extent as finally to consider herself as the anointed for dispensing to the rest of the world the blessings of Kultur.

The Germany of today is sick with the sickness of hatred. Economic war, wailing notes, conferences, blaming others are like patent medicines; the medicine Germany needs is just plain honesty toward herself and others.

Hate, far more than anything else, is now corroding

DISTINGUO ALLEMAND



— Après Petersdorf Hamborn, après Hamborn Gierwitz! Il faut q e cela cesse..
— Mais, Mylord, pourquoi vous fâchiez-vous? Il n'y a jamais d'Anglais « accidenté ».

*This is the seventh of a series of articles by Mr. Negru on this subject. The preceding articles appeared in the issues of Oct. 18, Oct. 25, Nov. 8, Nov. 15, Nov. 22 and Nov. 29. This article was written in September, 1922.
Chem. & Met., Jan. 31, 1923.

the German people. They have made out of it a new religion, "Hatredism," if I may use this expression, which they worship with fervor. France conveniently personifies the mortal enemy of their good god Kultur, hence it is on France that all Germany's imprecations are heaped. The leaders in Germany well know that others, in particular England, were and are just as mortal enemies of their type of Kultur, but it would not do to use them all at the same time, as the masses of worshippers might then be confused as to which was which; hence the superficial tolerance for the non-French.

The accompanying cartoon "German Distinction," by Louis Raemaekers, taken from the April 16, 1922, issue of *Le Soir*, Brussels, illustrates better than words could do the idea which the Germans have of tolerance. The caption reads:

ENGLAND—After Petersdorf Hamborn, after Hamborn Gleiwitz! This must stop.

GERMANY—But, my lord, why are you offended? There are never any English casualties.

This refers to the occurrence when French soldiers were killed and wounded by the explosion of concealed ammunition.

HATRED OF FRENCH IS BRED SYSTEMATICALLY

The Germans have a league for the protection of the German Kultur (Liga zum Schutze der deutschen Kultur). I had heard something about the activities of this league and of its itinerant exhibition, giving a series of graphical and statistical descriptions of what the peace treaty meant to Germany. I had an opportunity to visit this exhibition in Berlin, which was the forty-second city in which it was held since it was conceived.

If ever there was an efficient means of arousing fanatic hatred, this kind of exhibition can surely claim first prize. It was unilateral and partisan, showing effects only and absolutely no trace of causes. The walls of the halls were covered with a series of tables, twenty-eight of them the subject of Wilson's fourteen points, the others dealing with Germany's lost colonies, lost German territory, loss of minerals and agriculture, payment for reparations and so on. In the main hall, a raving anti-French denunciator and agitator was addressing the audience, which looked like a congregation of raptured fanatics.

The masterful poster for this exhibition is here reproduced. Can there be any more suggestive picture resembling a huge antediluvian animal with a heavy body and a diminutive head? It is entitled "The Chained Germany."

I am a believer in free speech, free press and the like. I have nothing to say against the exhibition, the speaker, and the audience. The exhibition is a business proposition, the speaker surely a hireling and the audience consisted of grown-ups, so all was what might be expected in any constitutional country.

But where I am compelled to draw the line is that in the morning preceding the day on which I visited the exhibition I saw a large group of girls about 14 years of age, accompanied by their teachers, waiting on the street and in the yard of 34 Wilhelmstrasse for the doors to open. I learned afterward that the forenoons were reserved for school children and their teachers. It is criminal to poison the minds of children with such exhibitions as these, especially when the parents of these children are exploited to the extent

that they receive only the very minimum-for-existence wages, at the time of which I write on the average of about \$2 per week. Would it not be far healthier for all concerned that instead of such exhibitions there should be in the German press honest accounts as to what really becomes of German work? Also, why it is possible that a workman receives only about \$2 per week, when the intrinsic value of the product of his work is even more than before the war, when he received at least \$6 per week. This is the condition which is the very cause of Germany's present plight.

MEETING A LOCKSMITH IN THE TIERGARTEN

This steady feeding of hate, which is so very conspicuous in every place which I visited in Germany, has embittered even the minds of their scientists. During a conversation with B., a leader in metallography, he used a language of hatred strikingly similar to that which I heard from S., a plain locksmith in a tent in the Berlin Tiergarten.

The meeting with B. was at my request, but that with S. was accidental and deserves to be related more in detail. It was on a Sunday afternoon. After a long promenade in the Tiergarten, I entered a tent show, paid the entrance fee, 6.20 marks (about 2 cents), sat down at a table and ordered black coffee. A few moments later a couple took their places at the same table, and also ordered coffee. When this was brought, the man



looked in disgust at the small pots of coffee and cups the size of demi-demi-tasse, if I may use that expression. He evidently expected to receive the large cups of coffee that I well remember in such places in the years gone by, especially since while waiting for the coffee the couple had taken out the sandwiches which they had brought with them for their lunch. When he learned that the price was 12 marks (about 4 cents) per pot, he started to argue with the waiter that it was too dear, and on learning that the price of beer was 7 marks, ordered the waiter to take the coffee back and bring them two glasses of beer instead.

This gave me opportunity to start a conversation which lasted about two hours and a half. I learned that he was a locksmith, earning 600 marks a week (about \$2). The entrance fee to the tent (6.20 marks each for himself and wife) plus the 12 marks for coffee, making a total of, say, 11 cents, was too much for them, as with this sum they could have purchased meat and bread for a good dinner. It furnished the pretext for a series of imprecations against the French and why an honest German workingman cannot afford even once in a while an enjoyable outing on a May day Sunday afternoon. The burden of his song was that the French

are the masters of Germany and squeeze out of her every drop of the proceeds of her work, etc. Needless to say, he believed that it was so.

Cannot the German intellectuals see that the exaggerated accusations against the French and others are driving the German masses to the fixed idea of a savage crazed with hatred? Can they not think of what might happen if these men were at last to learn that their work has served in reality to enrich a few Germans and to alienate the good will of the rest of the world, because of the very abnormal low selling prices of the products of their work?

It will not be long before the German masses will learn that huge sums are being placed by German industries in foreign countries and that the payments already made for reparations are a small proportion only of the German annual productive wealth.

I may cite here the following which was printed in *Le Matin* of Paris, under the heading "Stinnes offers to Yugoslavia a Loan of \$100,000,000:"

Belgrad, 8 May, 1922—*Novosti* of Belgrad, the governmental organ, announces that a financial consortium, behind which is the famous Hugo Stinnes, has lately offered to the Yugoslavian Government a loan of \$100,000,000 for the construction of new railways from the interior of the country to the Adriatic ports.

What Germany needs now more than ever is not to hear hate, read hate and think hate, but to have her workmen get wages commensurate with the true value of their work and sell her products at honest prices.

Other articles by Mr. Negru on this subject will be published in subsequent issues.

Legal Notes

BY WELLINGTON GUSTIN

Where Combination of Old Elements Is Patentable

The Circuit Court of Appeals of the United States at St. Louis has affirmed the judgment of the District Court in a suit brought by the Laclede Christy Clay Products Co. against the City of St. Louis and has denied a rehearing on the matter. (280 Federal, 93.)

SUSPENDED ARCH CONSTRUCTION ANTICIPATED

Suit was brought by the Laclede Christy Clay Products Co. against the city for infringement of a patent, known as the Girtamer patent, No. 986,455, claims 1 to 3. This patent covers claims for a furnace arch having parallel I-beams on which are brackets from which tile are suspended by a tongue and groove arrangement. The court found there was not only anticipation by prior patent issued to Stimmel, No. 944,296, and to Green and Gent, No. 676,606, and to Poppenhusen, No. 783,132, in the use of more than one transverse support; but also the question whether two (or more) I-beams (or girders of other form) should be used as called for in the three patents rather than one as called for in Girtamer's first patent, No. 910,809, was a question answered by mechanical suggestion when it is desired to make the arch longer. Again, the court said there was nothing new in the patent in suit, for Girtamer's first patent has the grooved tile fitting into lateral extensions of pendent portions of the brackets.

Even this point is identical with Green and Gent's patent.

USE OF SEVERAL PARTS INSTEAD OF ONE TO PRODUCE SAME RESULT NOT INVENTION

It was contended that Girtamer's first patent called for one transverse I-beam which supported integral brackets extending rearward and forward over the length of the arch, while the structure disclosed in his second patent, which calls for two I-beams spaced apart, with brackets in three separate pieces, one extending forward from the front I-beam, one extending rearward from the rear I-beam, and one between the two, demonstrate inventive genius in devising a means of lengthening the arch. But a plurality of transverse supports was disclosed in prior patents, and Girtamer lengthened the arch in the same way by using two beams instead of one. The court says that was anticipated if patentable, though it thought this was wholly within mechanical suggestion.

"Ordinarily, the making of two or more parts out of a thing that had before been used in one part, and using the separate parts to serve the purpose that had been served before the division is not invention," says the court.

WHEN COMBINATION OF OLD ELEMENTS IS PATENTABLE

"However, where a discovery embodies co-acting elements, although they be old, yet, if when brought together in a way not theretofore known, they produce by their interaction a new and useful result, the combination is patentable. (Regent Mfg. Co. vs. Penn. Elec. Mfg. Co., 57 C. C. A., 334); and if one of the elements in the combination be removed or changed so that their interaction is then in another way (in obedience to a different co-operative law), there is nevertheless invention, although the same result is attained, for in that case a different idea of means expresses the discovery, and the new is not an equivalent of the old."

But it further says that whether the change or rearrangement of those elements has, in their co-action, produced the old result in a different way is always a question of fact in any particular case. In the case at bar the court failed to find that the change produced the old result in any different manner. The three elements in combination, whether the brackets be integral or in three parts, were utilized for the same purpose, and perform the same functions in the same way and produce the same result for which they were used in other prior patents.

Fatigue Resistance of Dirty Metal

During the war a series of fifty steels was made by H. W. Gillett of the Bureau of Mines having the rarer metals as principal alloying elements. These steels are now being tested for endurance to repeated bending, especially in the hardened condition. It was found that non-metallic inclusions have a very detrimental effect on such specimens, and an independent investigation on this subject is being planned. The effect on repeated bending tests, of various amounts of lead in wrought brass, and of various amounts of copper oxide in copper is to be studied. This particular phase of the problem was brought up by W. R. Webster, of the Bridgeport Brass Co., as being of importance in itself as well as in its bearing on the general problem.

Book Reviews

SAMPLING AND ANALYSIS OF COAL, COKE AND BYPRODUCTS. Methods of the Chemists of the United States Steel Corporation. Second edition. Published by the Carnegie Steel Co., Bureau of Instruction, Pittsburgh. 184 pages, including many illustrations. Price, \$3 (cash with order).

While this book now appears as a second edition, it is virtually a new work, for the old material has been rewritten and revised and many new methods and tests not covered in the former edition are included in the new. In fact the new book is more than double the size of the first edition. The scope and purpose of the work are splendidly given in the preface to this new edition, as follows:

"The first edition of *Methods for the Sampling and Analysis of Coal, Coke and Byproducts* has served very usefully the purpose for which it was intended. However, the rapid growth of the byproduct coke industry in this country during the comparatively brief interval since the preparation of the original pamphlet has brought about many changes in byproduct laboratory practice. This consideration led to a decision to rewrite the text, so that the methods described therein could be brought up to date. Accordingly, a committee composed of chief chemists from the largest coal and coke laboratories of the various constituent companies of the United States Steel Corporation was appointed to co-operate in carrying out the work to that end.

"In addition to revising the pamphlet so as to describe the most recent methods employed in coal and byproduct laboratories, it has been deemed advisable to add several new features, among the most important of which are physical tests on coal and coke, the fusibility of ash, and methods for determining sulphur according to the way it exists in coal."

Very frequently industrial plants find it difficult to determine what methods should be used in the laboratory in order to get the most significant commercial results. In the field of coal and coke this has not been as widely true as in some other industries, for there have been standard methods for many of the determinations commonly used, fixed by joint action of the American Chemical Society and the American Society for Testing Materials. Nevertheless it is of great interest to have clearly set forth the methods employed in a large group of laboratories such as those of the Steel Corporation. This work will, therefore, be widely appreciated even by those whose needs are generally met by these standard procedures fixed by societies' committee action and in many cases this work will fill the many gaps still remaining in these standard procedures.

The work should be widely useful in coke-oven plants and in gas works. In fact it promises to be quite as valuable

to the gas-works chemist as any other volume, for the methods are given in a clean-cut, understandable style that leaves little opportunity for misunderstanding by the analyst. In this respect the work is worthy of particular commendation, so many of the earlier tests have inextricably mixed discussion of theory, statement of laboratory procedure and incidental comment on interpretation of results. The present volume avoids this complication very happily. It is just exactly what it purports to be, a set of fixed and definite instructions for the laboratory man to follow unincumbered by extraneous discussion which more often than not leads to confusion.

In the teaching of chemical engineering, especially for courses in gas and fuel analysis, this work should also be widely useful. Teachers will do well to include in their course of instruction a clear understanding of such methods as are given, for the student upon graduation will be better able to use the results of a laboratory test if he has had clearly brought to his attention the difference in significance between these tried and proved methods, used with success on a large scale, and the heterogeneous mass of test procedures that accumulate in our literature as the "half-baked" product of small laboratories that lack the vision and commercial experience to get the best results.

R. S. MCBRIDE.

Synopsis of Recent Chemical & Metallurgical Literature

Citric Acid and Citrate of Lime

The Department of Agriculture in its Circular 232 entitled "By-Products From Citrus Fruits" by E. M. Chace, gives the following recommended methods for making citrate of lime and citric acid. In this circular it is also suggested that those interested may be able to get additional information from the Laboratory of Fruit and Vegetable Chemistry, 148 South Anderson Street, Los Angeles, Calif.

CITRATE OF LIME

Boil the juice expressed from lemons or limes with large-grained infusorial earth, in the proportion of from 5 to 10 pounds of the earth to 100 gallons of juice. Separate the infusorial earth and coagulated material from the juice by filtration, bring the juice to boiling again, and neutralize it with ordinary lime or very pure ground limestone. Filter the precipitated calcium citrate, and wash it once or twice with boiling water. If citrate of lime is the end product desired, filter it, dry it thoroughly, and pack in waterproof packages.

CITRIC ACID

If citric acid is the end product desired, thoroughly mix the calcium citrate with water, in the proportion of 1 to 10 parts, and add an equivalent part of sulphuric acid. Separate the

calcium sulphate from the dilute citric acid solution by filtration. Evaporate the filtrate in vacuo, and allow it to crystallize. Redissolve the first crystals, which usually are not of commercial grade, filter them through bone-black, and recrystallize. Mother liquors may be returned to be worked over again with a fresh batch of juice, or they can be repurified by recrystallization.

The main problem in the manufacture of citric acid is to secure a satisfactory container for evaporating the dilute citric acid solution. Wood is the most satisfactory material wherever it can be used. Enamel lined vacuum pans or pans constructed of Monel metal are most favored by those who are manufacturing citric acid on a large scale.

Treatment of Rock-Drill Steel

Messrs. Foley, Clayton and Burnholz will present a "Review of Present Status of Drill Steel Breakage and Heat-Treatment" to the American Institute of Mining and Metallurgical Engineers in February. From an inspection of operations at sixty mines in the Western states, it was found that six had once had pyrometers on their heating furnaces, but five had discarded them. The trouble appeared to be due to small furnaces. In order to get out more drill bits, they were either withdrawn before attaining furnace temperature, or the furnace was greatly overheated. In any case, the pyrometer was useless. Sometimes Le Chatelier optical pyrometers were used to sight upon the hot tip as it rested on the edge of the quenching tank. Under these circumstances, the reading may be within 100 deg. of correct. Magnets are extensively used. A badly overheated bit—where the heat creeps back along the shank—will ordinarily be placed under a faucet to cool before quenching the top. The operator evidently knows that steel should not be quenched from too high a temperature, but does not know that an overheated steel is damaged beyond cure by mere heat-treatment.

Furnace atmospheres are always oxidizing; bits are usually quenched cold in water and not drawn. Under such circumstances the first few blows mushroom the soft cutting edge of a decarbonized bit—if the carbon remains, the very brittle edge is spalled against the hard rock. Either of these tools has about the same life—they work continually in a dulled state. There are so few parallels of this practice of using quenched high-carbon steels to resist impact that one can only speculate upon the advantages to be gained by giving the steel a correct microstructure.

In ten of the mines visited the drills were quenched from the hammer. Thus the finishing temperature varied, also the end strokes given by the smith are always quite light. Consequently the drills would be expected to have quite variable but in general quite large grain size. Even when the steel was

reheated for hardening, it was heated not nearly as far back as it was in the forging heat. In quenching, only $\frac{1}{2}$ to 1 in. of the end is immersed in the water; apparently the heat back of the end is relied upon to creep forward and give the necessary draw.

Variable as is this practice, it is constancy itself compared with the heat-treatment of the shank end. The result is a shank having a Brinell hardness anywhere from 250 to 700. That end of the rod should be hard enough to resist mushrooming, and yet not hard enough to chip itself or the hammer piston. Apparently anything from 250 to 700 Brinell satisfies these requirements, because little or no complaint is heard about breakages there.

Lignite Chars

A new member of the fuel family in Germany has been given the name "grudekoks," which means "embers coke." For some time in the United States we have been hunting for a suitable name for the material that remains after subjecting lignite to a heating process in order to drive off most of the moisture and volatile matter. O. P. Hood, chief mechanical engineer for the Bureau of Mines, the author of an article on grudekoks in a recent issue of *Coal Age*, suggests that the term "lignite char" might be taken as the American equivalent of the German product.

In order to improve lignite as a fuel, it is desirable that a large proportion of its water, from 25 to 40 per cent, be driven off in order to concentrate the fuel values sufficient to warrant transportation and to make a stable product. With the water removed, there remain the ash and about equal parts of volatile matter and fixed carbon. The volatile matter may be more valuable as a source of by-products than as a raw fuel, and also if partly removed the resulting char is mechanically stronger. This material, here called lignite char, is very similar in composition to a Pennsylvania semi-anthracite, but physically it is quite different. In expelling the moisture from lignite the material breaks up into very small pieces.

The material is gray black; it is clean to handle and does not deteriorate in heating value on exposure.

In central Germany the brown coal deposits contain a similar material which when subjected to low-temperature distillation yields a high percentage of tar. It appears in the brown coal bed as lighter colored layers, which are mined separately from the darker material. This lighter colored brown coal is subjected to low-temperature distillation in a circular kiln of simple construction, the resulting char being considered as a byproduct, since the main objective in this process is the paraffine contained in the tar.

No attempt has been made in Germany to briquet this material, since the Germans have found an acceptable way of burning the fine char direct without further processing.

Recent Chemical & Metallurgical Patents

American Patents Issued Jan. 16, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.*'s staff and those which, in

our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,442,034—Oil Burning Furnace. G. C. Adams, California.
1,442,089—Chemical Fireproof Paint. Peter Osterhouse, Richmond, Mich.
1,442,301—Electrical Precipitation of Particles From Gases. W. A. Sheek; assigned to International Precipitation Co. of Los Angeles, Calif.
1,442,304—Apparatus for Treating Material. A. R. Spencer and W. J. Plews, Cleveland.
1,442,317—Recovery of Constituents of Waste Liquor. C. T. Whittier; assigned to Royal Baking Powder Co.
1,442,318—Preparation of Dry Granular Calcium Acid Phosphate. C. T. Whittier; assigned to Royal Baking Powder Co.
1,442,319—Compressor. E. Wilson; assigned to Wilson Eng. Co., St. Louis.
1,442,330—Cooling and Refrigerating Solution. N. A. DuBols, Massachusetts.
1,442,339-340-341—Albuminous Animal Waste, etc. P. Hildebrandt, Germany; assigned to Chemical Foundation.
1,442,386—Glycols. G. O. Curme and C. O. Young, Pittsburgh; assigned to Carbon & Carbide Co.
1,442,406—Anhydrite as Source of Substance Which Sets in Presence of Water. R. Hennicke; assigned to Kalwerke Salzdefurth A. G.

1,442,413—Refractory. Z. Ollson; part assigned to A. R. Oppenheim.
1,442,414—Bringing Gases Into Contact With Liquids. W. H. Rose, Jersey City.
1,442,420—Reactive Composition. L. H. Baekeland; assigned to Baekelite Corporation.
1,442,485—Production of Fine Powders. W. K. Lewis; assigned to Good-year Tire & Rubber Co., Akron.
1,442,491—Method of Chlorination. J. B. Marvin, Saranac Lake, N. Y.
1,442,494—Treatment of Liquid Waste Containing Combined Carbon. J. E. Plimstead; assigned to Jessup & Moore Paper Co., Philadelphia.
1,442,520—Purification Isopropyl Ether. H. E. Buc; assigned to Standard Development Co. of Delaware.
1,442,619—Treating Air. A. B. Lamb, Washington, D. C.
1,442,631—Products Made With Cellulose Derivatives. L. G. Richardson; assigned to American Cellulose & Chemical Manufacturing Co., Ltd., New York City.
1,442,743—Process for Making Phenyl Glycerine. C. J. Strossacker; assigned to Dow Chemical Co., Midland, Mich.
1,442,773—Crystalline Product. H. A. Richmond and R. MacDonald; assigned to General Abrasive Co., Niagara Falls.

Complete specifications of any United States patent may be obtained by remit-

ting 10c. to the Commissioner of Patents, Washington, D. C.

Extraction of Vanadium, Uranium and Radium From Certain Ores—W. F. Blecker, of Boulder, Colo., has assigned to the Tungsten Products Co., of Boulder, Colo., the following patent. It has to do with the separation of vanadium, radium, uranium and other compounds from various ores. The process consists first of grinding up the ore to about 20 mesh, adding 50 per cent its weight of sodium carbonate and treating the paste so formed in an autoclave at about 90 lb. pressure at 150 deg. C. temperature. The resulting liquors contain the sulphate obtained by the decomposition of barium and radium sulphate, as well as uranium and vanadium compounds. These are at once filtered off and evaporated in some suitable manner. The barium-radium compounds are separated by means of hydrochloric acid. (1,438,357. Dec. 12, 1922.)

Separation of Chloracetones—When isopropyl alcohol is chlorinated at a temperature of about 65 deg. C., the liquid products of the reaction separate into two layers: a heavy lower layer containing chiefly chlorinated acetones and a supernatant layer containing chlorinated acetones in solution. The chlorinated products consist of dichloracetone (asymmetric), trichloracetone (such as 1.3.3), tetrachloracetone (symmetric), and pentachloracetone. It

has been found that the components of such a mixture can be separated by extracting the mixture with water, thereby forming an aqueous solution principally of the tri- and tetra-chloracetones, separating the aqueous solution from the residue, "salting out" the chloracetones from the solution, fractionating the separated chloracetones, extracting the residue above mentioned with an aqueous solution of NaHSO_4 , thereby dissolving the dichloracetone and, finally, decomposing the solution of dichloracetone to remove this compound from the mixture. (1,436,950. Hyym E. Buc, assignor, by mesne assignments, to the Standard Development Co. of New York. Nov. 28, 1922.)

Guanidine Nitrate—Tenney L. Davis, of Somerville, Mass., has been granted a patent on a process for the preparation of guanidine nitrate from dicyandiamide, which he claims will give practically double the yield of the present process, involving the intermediate formation of guanylurea. Dicyandiamide and ammonium nitrate, in such proportions that there are present two molecules of ammonium nitrate for each molecule of dicyandiamide, are heated to 160 deg. C. in an autoclave for two to six hours. The dicyandiamide first combines with one molecule of ammonium nitrate to form biguanide nitrate, and upon further heating at a proper tem-

perature, the biguanide nitrate combines with the other molecule of ammonium nitrate to form two molecules of guanidine nitrate. (1,440,063. Dec. 26, 1922.)

Perchlorate Explosives—Numerous attempts have been made to produce an explosive more powerful than or equally as powerful as dynamite, yet possessing superior qualities with respect to stability, economy, resistance to freezing or physiological effect—nitroglycerine headache. Among the proposed substitutes for nitroglycerine dynamite may be mentioned the mixtures of chlorates, sodium or potassium, with resins, gums and nitro-aromatic compounds and mixtures of inorganic nitrates with resins or nitro-aromatic compounds. In general, however, the substitutes have not met with favor because of the low initial sensitiveness and of the tendency of the powder to become hard. Russell M. Cook, of Tamaqua, Pa., has patented an explosive which he claims combines the desirable properties of perchlorate explosives and nitroglycerine dynamite, yet eliminates the undesirable properties of both. A number of formulas are given in the patent disclosure. One example consists of 30 per cent ammonium perchlorate, 7 per cent manganese dioxide, 36 per cent sodium nitrate, 24 per cent TNT, 2 per cent nitroglycerine and tetrinitro diglycerine, and 1 per cent chalk.

The purpose of the explosive liquid organic nitrate is to raise the propagation sensitiveness of the perchlorate explosives, so that they compare more favorably in this respect with dynamite, and can be successfully used in special cases in which at present only the more sensitive nitroglycerine dynamite can be applied. The patentee claims that the sensitiveness of the explosive compound is not affected by age. Patent 1,440,768, by the same patentee, covers the use of sodium or potassium perchlorate instead of the ammonium salt. (1,440,767. Jan 2, 1923.)

Iodine Compound—Rezso Benko, of Budapest, Hungary, has taken out a patent on a substance which he assumes to be gelatine-hexamethylene-tetramine-di-iodine for which he claims some novel properties. It is said that a solution of the compound is considerably less poisonous than iodine and will, on being introduced into the body by injection, deposit almost its total content of iodine. The substance is made by heating a solution of an albuminoid or a neutralized product of decomposition of an albuminoid, such as gelatose, with hexamethylene-tetramine-di-iodine, filtering the solution and evaporating to dryness in a vacuum. The compound is said to be readily soluble in water and in glycerine, with a slightly yellow color, forming a yellow precipitate with silver nitrate and giving free iodine with acids. (1,440,813. Jan. 2, 1923.)

Dyeing Cellulose Acetate—The use of trisodium phosphate for the treatment of cellulose acetate artificial silk to render it permeable to dyeing solutions

is covered by patent granted to Edouard Paul Sisley of Lyon, France, assigned to Société Chimique des Usines du Rhone of Paris. In an example the artificial silk is slowly agitated for three-quarters of an hour to one hour in a bath containing 25 grams of crystallized dibasic phosphate of sodium and 5 cc. of caustic soda solution 36 deg. Bé. The bath is maintained between 60 and 70 deg. C. during the whole operation. The silk is then thoroughly washed and dried, the loss of weight being 6 per cent. A process can be applied to pure cellulose acetate fabrics or to mixed fabrics, such as cellulose acetate silks and natural silks, or cellulose acetate silk and wool. (1,440,501. Jan. 2, 1923.)

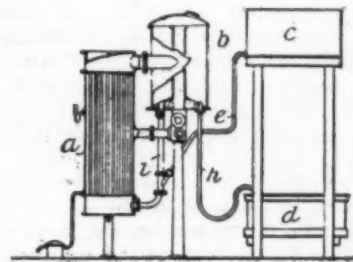
British Patents

For complete specifications of any British patent apply to the Superintendent, British Patent Office, Southampton Buildings, Chancery Lane, London, England.

Cyanamide—In the production of solutions of free cyanamide by gradually adding calcium cyanamide to a circulating body of water or cyanamide solution into which carbon dioxide is admitted, the process is carried out in such a way that the quantity of liquid between the points where the calcium cyanamide and carbon dioxide respectively are supplied is constant and small compared with the total quantity of liquid, notwithstanding the increase in bulk owing to the addition of the calcium cyanamide. The result is that each

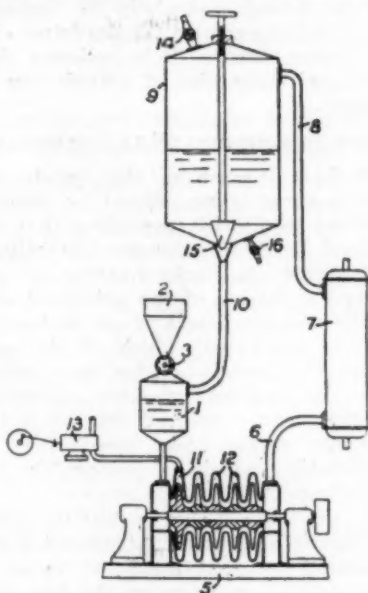
increase in the bulk of the circulating liquor. From the tank 9 the liquor is passed by a valve 15 and pipe 10 to the tank 1. The pipe 8 is preferably tangential to the tank 9 so as to facilitate the escape of gas, which is led off by a pipe 14. The finished solution is withdrawn at 16. (Br. Pat. 186,020. Wargons Aktiebolag and J. H. Lidholm, Wargon, Sweden. Nov. 8, 1922.)

Distillation and Evaporation—In apparatus for evaporating and distilling liquids in which the liquid passes upward through the tubes of a calandria *a* to a vapor-separating chamber *b*, a part of the concentrated liquid flows from the chamber *b* by a pipe *h* to a tank *d*, and the other portion of the concentrated liquid is returned by a pipe *i* to the base of the calandria together with fresh liquid from a tank *c*



and pipe *e*. Part of the vapor evolved in the chamber *b* may be forced by an injector, fan or pump into the space surrounding the tubes of the calandria to serve as heating agent. The apparatus may be used under pressure or vacuum and as an element of a multiple-effect apparatus. In a modified form of apparatus, the end boxes of the calandria are divided by partitions to give the liquid a longer travel, and the fresh liquid is preheated by heat exchange with the concentrated liquor and also with the condensate from the calandria, which may also be used to wash out the tubes of the calandria. The apparatus may be used for the recovery of benzene from oils and greases. (Br. Pat. 185,873. J. L. Ferguson, Glasgow. Nov. 8, 1922.)

Coke—In the production of smokeless fuel and coke, a blend is made of two coals or of coal and coke, semi-coke or ore so that the resinic content of the blend is not less than 5 per cent but preferably not less than 8 per cent of the weight of the blend. This blend is heated to a temperature not exceeding 500 deg. C. or to a temperature of from 50 to 100 deg. C. above the minimum temperature at which the resinic matter is destroyed. To increase the contraction of the blend, the volatiles evolved between 350 and 400 deg. C. should be below 7.5 per cent. Blended coals may be treated as described in specification 175,888—that is, first preheated and then heated to 500 deg. C. and the product subsequently carbonized at 900 to 1,000 deg. C. The products of the process described in specification 164,104 may form part of the blend. (Br. Pat. 186,085. S. R. Illingworth, Brynffedwen, Radyr, Glamorgan. Nov. 15, 1922.)



addition of calcium cyanamide is only a short time in the liquid before reaching the carbonic acid, and only a small proportion of the liquid is alkaline. Calcium cyanamide is fed from a hopper 2 by a valve 3 into a small tank 1, from which the liquor passes to a pumping device 5 containing a centrifugal wheel 11 and mixing vanes 12. Carbonic acid is supplied by a pump 13 and is mixed with the liquid in the apparatus 5. The liquor then passes through a pipe 6 to a cooler 7 if necessary, and thence by a pipe 8 to a large tank 9, which is capable of accommodating the

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields
Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

Arsenic Report Regarded as Too Optimistic

Consideration of Findings of Department of Agriculture Arouses Feeling
That Government's Expert Is Prejudiced—Federal
Trade Commission to Investigate

STUDY of the arsenic report submitted to the Senate on Jan. 18 by the Secretary of Agriculture leads many chemical specialists to believe that the findings are more optimistic than the situation warrants. The general reaction, and this is supported by letters reaching members of Congress from persons acquainted with the situation, seems to be that the main object of the report was to depress the price of calcium arsenate, or at least check possible advances. It is pointed out that this would be the natural attitude on the part of B. R. Coad, who undoubtedly is responsible for the principal economic deductions in the report. Mr. Coad is in charge of the laboratory which the Department of Agriculture maintains at Tallulah, La. This laboratory was located in the heart of the cotton belt for the specific purpose of studying methods of boll weevil control. It was there that the adaptability of calcium arsenate to that purpose was demonstrated.

THINK COAD PREJUDICED

After having worked out the most promising method ever devised for boll weevil control, Mr. Coad is certain to be keenly disappointed by the interference with its application by the increase in price and lack of the poison. The belief is expressed that, without intending to do so, he has reported on the situation in a way which, to say the least, would not be an additional reason for a further advance in prices.

It also is declared that Mr. Coad's estimate of the demand up to May 1, 1923, is absurdly low. This is particularly the case, it is said, in estimating the requirements for glass manufacture and for the manufacture of lead arsenate. Issue also is taken with his estimate of 3,500,000 tons as being the annual requirement for calcium arsenate.

Many are of the opinion that the demand for white arsenic will increase much more rapidly than its production and that the shortage a year hence will be much more acute than it is today. It is pointed out that the increase in production in the United States will be slow. The output at the smelters can be calculated very closely. Inquiries into the possibilities

of production on the part of the Salt Lake Insecticide Co. developed the fact that its production, which will begin about Feb. 1, will not exceed 15 tons a day for a considerable period and while that output eventually can be increased, there is no immediate prospect for the large production in that quarter which some have predicted.

There has been some suggestion that the flexible tariff be applied to calcium arsenate, which is dutiable at 25 per cent ad valorem. In that connection it is pointed out that the manufacturers will not oppose such action, but that it would have very little practical effect, since it would be unprofitable to pay freight on the lime. Arsenic itself is on the free list. All are agreed, however, that the situation cannot be helped materially by imports. The greatest promise for the future lies in Mexico, where it is believed that additional recoveries of arsenic can be secured.

TRADE COMMISSION WILL INVESTIGATE

Without discussion, the Senate approved a resolution offered by Senator Fletcher of Florida providing that the Federal Trade Commission "investigate and report the facts relating to any alleged violations of the anti-trust acts by the manufacturers of, or dealers in, calcium arsenate." Such of the government's specialists who have looked into the calcium arsenate situation, however, are convinced that it is the shortage rather than speculation or combination which is responsible for the enhancement of the price.

On the heels of this resolution, Senator Harris of Georgia introduced a bill to amend the 1922 tariff act so as to place calcium arsenate on the free list. The commodity is not mentioned specifically in the tariff act, but the Customs Division of the Tariff Commission agree that calcium arsenate is dutiable as a chemical salt at 25 per cent ad valorem under paragraph 5 of the act.

Because it is the principal ingredient of calcium arsenate, white arsenic was put on the free list, Senator Harris said, and the evident intention of Congress was that calcium arsenate should be free.

Dr. Miller Reese Hutchison, manag-

5,000 Research Problems Concern Agriculture

More than 5,000 research projects are under way at the agricultural experiment stations throughout the country, it is announced by the Department of Agriculture. They include many problems involved in fertilizer requirements, the study of soils, the control of pests and other work which requires the application of chemistry.

ing director of the national campaign for boll weevil control of the American Cotton Association, in a letter to the *New York Journal of Commerce* denies that he intends to engage in the manufacture of calcium arsenate. He claims that the efforts of the association are directed toward developing, first, an ample supply of calcium arsenate at a reasonable price; second, an organization to insure that this substance is available to the farmer and to conduct research looking toward improved methods of application and improved insecticides.

Mention is made of the sources from which Dr. Hutchison previously intimated that calcium arsenate could be obtained as follows:

"The publicity that has been laudably given this campaign for the control of the boll weevil has brought out some very interesting and heretofore unknown and unconsidered resources. Among them are several processes for the manufacture of calcium arsenate, which do not require the white arsenic of commerce. It is from such sources that the tonnage, in excess of that pronounced available by governmental and other agencies, will be secured."

COUNTERVAILING DUTIES ANNOUNCED

Instructions for the assessment of countervailing duties on imports of calcium acetate were issued to collectors of customs on Jan. 23 by the Treasury.

The Treasury listed the duties imposed on calcium acetate in various countries as follows: Belgium, free; Germany, 1 gold mark per 100 kilos; Hong Kong, free; Japan, 0.41 gold yen per 100 kin; Mexico, 0.07 gold peso per kilo, plus additional surtaxes amounting to 12 per cent of the duty; Netherlands, free; Norway, free; Panama, 15 per cent ad valorem; Sweden, acetate of lime, raw or purified, 0.03 gold crown per kilo; United Kingdom, 11½ per cent ad valorem.

Meat Packers Perfect Development Plans

Establishment of a national institution combining broad educational, research and trade association facilities is assured for the meat packing business, according to an announcement by the Institute of American Meat Packers in the name of Thomas E. Wilson, of Chicago, chairman of the organization's "development plan commission." Mr. Wilson's statement, in part, follows:

Sufficient funds now have been subscribed by the meat packers of America to begin actual development of the Institute plan. This plan provides for the ultimate development at Chicago of a combined educational institution, research institute, trade association and industrial museum.

Approximately \$150,000 has now been subscribed by the meat packers of the United States to cover the necessary surveys and initial developments during a 3-year period. These special subscriptions are entirely in addition to the regular revenues received by the Institute for carrying on its present educational and trade activities.

Systematic instruction will be provided for men already engaged in the industry as well as for men intending to enter the industry. The packers of the United States have authorized the creation forthwith of a bureau of industrial education and the engagement of an educator of distinction in this field to direct it. A thorough-going survey of the educational possibilities and difficulties of the American meat-packing industry will be made, and future provision for instruction—respecting both methods and kinds—will be shaped largely by the results of the survey.

Similarly a bureau of scientific research will be established at once and a competent director of standing engaged. A survey of the scientific problem of the industry will be made. It is believed that much duplication of research can be eliminated and that many research projects can be undertaken which would be too costly or of too general benefit to justify their prosecution by an individual company. It is believed that co-operative research will effect many savings and solve many scientific problems of the industry on which information is now incomplete. Nor is it believed that such a plan will interfere with the research work done by individual companies in their respective plants and laboratories.

In the same way provision has been made for creating without delay a bureau of packinghouse practice and research. This bureau, directed by an expert on packinghouse operations, will function in furtherance of purposes similar to those just mentioned.

Development of the plan will mean the creation of an institution which combines with the research and technical educational facilities of Continental industrial institutes the trade activities and exposition features of American business associations.

Engineers Urge Study of Gold and Silver Situation

That more than mining engineers are interested in legislation proposing to study the situation which will overtake silver mining when the Pittman act expires is indicated by a communication received by the Senate Committee on Mines and Mining from the Federated American Engineering Societies. The Committee on Mines and Mining is considering legislation proposing to set up a Congressional committee, along the lines of the Committee on Agricultural Inquiry, to study the silver and possibly the gold situation. The letter from the Federated Societies reads as follows:

"Engineers in all branches of the profession are much interested in the welfare of the metal-mining industry and in the activities which depend directly and indirectly upon that industry. For that reason, the Federated American Engineering Societies wishes to urge on your committee the advisability of a careful study of the problems which this nation is facing as a result of the handicaps which surround the production of gold and which soon will envelop the production of silver.

"Since these matters concern many more activities than those immediately involved, the engineers of the country are much interested in seeing the entire subject illuminated as much as possible.

"This organization, therefore, urges that your committee report favorably some such legislation as is now before you and asks that no effort be spared to secure the enactment of the bill at this session of Congress."

European Conditions to Be Discussed at Joint Meeting

A joint meeting of the four chemical societies having sections in New York City will be held in Rumford Hall, Friday, Feb. 9, under the auspices of the American Electrochemical Society. W. S. Landis, chief technologist of the American Cyanamid Co., will be the principal speaker, his subject being "European Conditions," a discussion of impressions received on his recent trip abroad.

J. S. Negru, managing editor of *Chem. & Met.*, will lead the discussion.

C.W.S. Corrosion Report Delayed

Recent announcement in *Chem. & Met.* of the report prepared by the Chemical Warfare Service on "Corrosion of Metals and Materials by Acids and Alkalis" has resulted in a large number of requests for this report to the Washington office of C.W.S. That Service regrets that there has been a temporary delay in supply of this document and that it is impossible at once to comply with the requests which have been made. However, it is hoped that an ample supply may be prepared and made available for distribution in the near future, at which time those who have requested it will be supplied.

Mining Engineers to Meet in February

Three Days Devoted to Technical Sessions at 127th Meeting

The 127th meeting of the American Institute of Mining and Metallurgical Engineers will occur at the Engineering Societies Building, New York, Feb. 19 to 22, 1923. A summary of activities interesting to metallurgists is shown below:

MONDAY, FEB. 19

2 p.m.—Session on Breakage and Heat-Treatment of Drill Steel.

2 p.m.—Session on metallurgy; considering heap leaching, zinc electrolytes, pyritic smelting, and gold recovery.

4 p.m.—Second annual lecture of Institute of Metals; "Solid Solutions," by Walter Rosenhain.

8 p.m.—Smoker.

TUESDAY, FEB. 20

2 p.m.—Institute of Metals.

"Nature of Solid Solutions," by Edgar C. Bain.

"Cored Crystals and Metallic Compounds," by Edgar C. Bain.

"Some Observations on Occurrence of Iron and Steel in Aluminum," by E. H. Dix, Jr.

"Polishing Aluminum and Its Alloys for Metallographic Study," by E. H. Dix, Jr.

"Density and Expansivity of Aluminum-Silicon Alloys From 20 to 1,000 Deg. C.," by J. S. D. Edwards.

"Practical Spectrographic Analysis," by W. F. Meggers, C. C. Kiess, F. J. Stimson.

8 p.m.—Motion pictures and dance.

WEDNESDAY, FEB. 21

9.30 a.m.—Session on Iron and Steel.

"Continued Discussion on Physics of Steel," by W. R. Webster.

"Specifications for Foundry Pig Iron," by Richard Moldenke.

"Influence of Temperature, Time and Rate of Cooling on Physical Properties of Carbon Steels," by H. M. Howe, F. B. Foley and J. H. Winlock.

2 p.m.—Discussion on Technical Education.

2 p.m.—Institute of Metals Division. "Occurrence, Chemistry and Uses of Selenium and Tellurium," by Victor Lenher.

"Determination of Gases in Metals," by Harold L. Simons.

"Study of Bearing Metals," by C. H. Bierbaum. (Illustrated.)

"Tests on High-Tin Bearing Metals," by P. W. Priestley.

"Bright Annealing of Copper Wire," by P. E. Demmler.

"Thermal Conductivity of Some Industrial Alloys," by H. M. Williams.

2 p.m.—Iron and Steel Session.

"Deterioration of Malleable in the Hot Dip Galvanizing Process," by W. R. Bean.

"Heating and Cooling Curves of Large Ingots," by F. E. Bash.

"Possibilities in Application of Colloid Chemistry to Production of Clean Steel," by H. W. Gillett.

"Low-Temperature Brittleness in Silicon Steels," by Norman B. Pilling.

6:45 p.m.—Annual dinner.

THURSDAY, FEB. 22

Excursion to American Brass Co.'s plants at Ansonia, Conn.

Long-Expected Exposition Report Appears

Salesmen's Association Suggests Plans to Improve Annual Chemical Show Which It Is Hoped Will Appease Everybody

FOR THE PAST three months a committee of the Salesmen's Association of the American Chemical Industry has been considering possibilities and plans for a new departure in the conduct of the Chemical Exposition. During and immediately after the last exposition—which was the eighth annual affair of the kind—considerable sentiment was voiced in disapproval of the present management. It was noised about that an opportunity to be of genuine service to the industry was being sacrificed to commercialism and that the price demanded of exhibitors was greatly in excess of the benefits they derived from their displays.

At the height of the dissatisfaction, the plan of holding a co-operative exposition designed to interest and attract representatives of the chemical industry rather than manufacturers of equipment was proposed by Adriaan Nagelvoort, who purposed to conduct such an effort in 1923. This program enlisted the interest of many in the industry, while others felt that the management of such a spectacle should be left to a private company which had the necessary experience and facilities.

The Salesmen's Association, in an attempt to weigh the merits of the opposing plans and decide on a course which would be of maximum benefit to the industry, appointed the committee whose report has just been completed. Briefly, the Salesmen express the belief that the exposition should be continued, presumably by the old management, with special and intensive efforts to improve its quality and to work with representatives of the industry for the ultimate good of the latter.

EXTRACTS FROM REPORT

Extracts from the report follow:

This report presents a plan for getting more tangible results. It records also definite accomplishments towards putting this plan into effect. The committee agrees that in its fundamentals this plan is sound and practical; its details are purposely left flexible.

ELEMENTS NECESSARY TO SUCCESS

To make the exposition a truly national chemical meeting and market place, a congress of scientific trade and consuming associations must be held and so guarantee the attendance of many desirable visitors.

To carry on the logical purpose of educational work to the public, students and chemical consumers a constructive, consecutive program must be worked out.

To accomplish this end the management of future expositions must work closely in co-operation with the industry. Policy must be guided and plans controlled by what the industry, as a whole, believes is for the common good, and this control

is just and proper because the support of the industry is virtually a franchise creating a monopoly in chemical shows. Even a private corporation conducting the exposition must fairly share the profits with the industry.

The attendance problem can best be solved by holding a congress of chemical and consuming industries. A common program, to avoid conflicts, can provide common entertainment features with one gigantic chemical industry banquet. The meetings of the participating associations would have to be a new and special type, devoid of routine business and paper reading, designed as get-together gatherings to discuss one or two big fundamental problems of broad interest.

EXPOSITION CO. CONTRIBUTES \$5,000

At the instance of your committee the directors of the International Exposition Co. voted Jan. 15 to turn over to the advisory committee 5 per cent of the gross receipts of the coming Ninth Chemical Exposition. This sum, which Mr. Payne estimates at not less than \$5,000, is to be spent by the advisory committee for the common good of the industry, on educational and other work in connection with the exposition.

The question of better representation for the executive and sales departments of the industry upon the exposition's advisory committee has been taken up with their chairman, Dr. Charles H. Herty.

Dr. Herty has invited your committee to meet with the advisory committee in order to confer on the new personnel of the advisory committee and to lay before them suggestions and offers of co-operation which we have received from many associations, firms, colleges and individuals in response to our questionnaire which was the subject of our preliminary report.

NAGELVOORT WITHDRAWS 1923 PLANS

After further consultation with your committee, Mr. Nagelvoort has agreed to withdraw definitely his tentative plans for a co-operative show in 1923. He takes the liberal view that the measure of co-operation with the industry which the International Exposition Co. offer should be tried fairly, and for the common good desires not to put the least obstacle in the way of hearty, united co-operation. We commend his attitude and indorse the sentiments he expresses.

While this report has been in preparation most of the feeling on the subject has died out and the report is not likely to arouse any great enthusiasm. Cooler heads in the industry look for a Chemical Exposition in 1923 much like its predecessors, although it seems probable that the late controversies will serve as a word to the wise.

Program of Joint Safety Engineering Meeting Announced

The need for and use of national codes relating to safety in the operation and maintenance of elevators and in building construction are the two principal subjects on the program of the joint meeting of the Engineering Section of the National Safety Council and the American Society of Safety Engineers called for Friday, Feb. 16, in the Engineering Societies Building, New York City.

The different phases of elevator safety will be discussed by D. L. Lindquist, chief engineer, Otis Elevator Co.; M. H. Christopherson, deputy commissioner, New York State Department of Labor; C. B. Connelley, commissioner, Pennsylvania Department of Labor and Industry; C. W. Old, vice-president, Shur-Loc Elevator Safety Co., Inc., New York; C. W. Bassett, associate engineer, Elevator Supplies Co., Hoboken, N. J.

George T. Fonda, chairman of the Engineering Section of the National Safety Council and a member of the firm of Fonda-Tolsted, Inc., Washington, D. C., will preside at the afternoon meeting on the proposed national building code. Those who will lead the discussion are: Ira H. Wilson, chairman, United States Department of Commerce; Sidney J. Williams, chief engineer, National Safety Council; and a representative of the New York State Industrial Commission. The motion picture "Paying the Price," depicting the dangers in neglecting minor injuries, will be presented by A. D. Risteen, director of technical research, Travelers Insurance Company.

The public safety problem of adequate control will be considered at an evening session. Richard E. Enright, New York City Police Commissioner; H. K. Maples, field secretary, American Automobile Association; David Van Schaack, Aetna Life Insurance Co., and others will discuss the subject.

British Interests Investigate Canada as Site for Paper Mill

Another striking evidence of the intention of prominent British firms to locate branches in the overseas dominions came to light recently with the arrival of the Empress of France at a Canadian eastern port, with a party of civil engineers representing the famous shipbuilding firm of Armstrong-Whitworth of Newcastle-on-Tyne. The immediate object of the party is to investigate the prospects of locating a pulp and paper plant in Newfoundland, presumably at Port aux Basques. In addition to this, however, the information was given out that coincidental with this development in Newfoundland it is the intention of the Armstrong-Whitworth interests to investigate similar prospects in the Province of Quebec, to which end arrangements have already been made for the reorganization of the company's Canadian headquarters at Montreal.

Dye Makers and Importers Reach Impasse

Difficulty Lies in Defining Competitive Products Entitled to Higher Duties Under American Valuation

Committees representing dye manufacturers, importers, manufacturing importers and consumers met at the U. S. Appraiser's Stores in New York City, Jan. 25, for the purpose of assisting in drafting rules and regulations to govern the appraisement of imported dyes. Special Deputy Appraiser John Donnelly, who presided, declared that the primary purpose of the meeting was to consider tentative lists of non-competitive dyes which under the new tariff are entitled to entry at comparatively low rates of duty. Thomas L. Doherty, customs adviser of the Synthetic Organic Chemical Manufacturers Association, reported that the dye makers were not willing to prepare lists of competitive or non-competitive colors until the customs authorities indicated how they were going to interpret that part of the tariff law which provides that "any coal-tar product shall be considered similar to or competitive with any imported coal-tar product which accomplishes results substantially equal to those accomplished by the domestic product when used in substantially the same manner."

Appraiser Donnelly said that the American manufacturers had been given the same opportunity as the importers to prepare their lists and in view of the fact that they had thus failed to cooperate with him, he declared the meeting adjourned. The rules and regulations, he said, would be worked out by the customs authorities in consultation with the importers, consumers and manufacturing importers.

DR. HERTY'S VIEWS

In explaining to *Chem. & Met.*'s representative the stand which the manufacturer's had taken, Dr. Charles H. Herty, president of the producers' association, pointed out the difficulties involved in defining the term "competitive," particularly from the manufacturer's viewpoint. "The importer," he said, "has nothing to lose and everything to gain in preparing his lists. If he includes a domestic made product among his non-competitive dyes, the only one to suffer would be the American maker. On the other hand, if the manufacturers put a color on the non-competitive list and later found that a domestic producer had already spent a large sum of money in developing the product, his entire investment might be wiped out by a single large importation."

Whether two dyes are competitive or not should be decided on the basis of degrees or respects in which the products are similar, according to Dr. Herty. Thus if the appraiser were to agree that dyes are competitive when they are similar in respect to color, or fastness, or chemical composition, or method of application, etc., it would be comparatively easy to prepare such a list.

A.C.S. President Will Visit Thirty-Two Sections

Announcement is made of the itinerary of E. C. Franklin, newly elected president of the American Chemical Society, in his speaking trip over the country. Prof. Franklin will speak in the following cities on the dates noted:

Los Angeles, Calif.,	March 16	Buffalo, N. Y.,	April 21
Houston, Texas,	March 19	Akron, Ohio,	April 23
New Orleans, La.,	March 21	Cleveland, Ohio,	April 24
Nashville, Tenn.,	March 22	Detroit, Mich.,	April 25
St. Louis, Mo.,	March 24	Ann Arbor, Mich.,	April 26
Pittsburgh, Pa.,	March 26	Midland, Mich.,	April 27
Morgantown, W. Va.,	March 27	East Lansing, Mich.,	April 30
Maryland,	March 29	Noire Dame, Ind.,	May 1
Boston, Mass.,	April 9	Lafayette, Ind.,	May 2
New York, N. Y.,	April 11	Urbana, Ill.,	May 4
Philadelphia, Pa.,	April 12	Evanston, Ill.,	May 7
New Jersey,	April 13	Milwaukee, Wis.,	May 8
Lehigh Valley,	April 14	Madison, Wis.,	May 9
Rochester, N. Y.,	April 16	Iowa City, Iowa,	May 11
Syracuse, N. Y.,	April 17	Ames, Iowa,	May 14
Cornell, N. Y.,	April 18-19	Minnesota, Minneap- olis and St. Paul,	May 16-17

Professor Franklin's talk before most of the sections on this occasion will be "The Ammonia System of Compounds—Experimentally Illustrated."

Conduct Research on Kerosene Fuels

The research laboratories of Carnegie Institute of Technology, Pittsburgh, have undertaken experiments to determine the relative efficiency of kerosenes and oxidized kerosenes as fuels. In accordance with the policy of the Institute to link up its educational facilities with modern industry, the department of chemical engineering has been conducting a series of tests to determine the relative merits of various oils as usable fuels. The completion of this important work should go a long way toward solving the problem of oil conservation, by the possible development of a new fuel.

According to a report by J. H. James, head of the department conducting the experiments, oxidized kerosenes cause less "knocking" than straight kerosene when used in a kerosene engine. The tests also showed that oxidized kerosenes have approximately the same power development as ordinary kerosene, in spite of the fact that their thermal value is one-eighth less. Dr. James attributes the efficiency of the oxidized kerosenes to the better "clean up" in the combustion of these partially oxidized fuels.

The success of the experimental work at Carnegie at this stage gives promise that oxidized kerosene, which is manufactured by catalytic oxidation from low-grade petroleum, may become a useful fuel in the future. Its properties may cause it to be used industrially in kerosene engines or blended with gasoline for use in gasoline engines.

Midgley Awarded 1923 Nichols Medal

Work on Gaseous Detonation and Anti-Knock Compounds Wins Award of American Chemical Society

The Nichols medal, awarded each year by the American Chemical Society to the author of the most exceptionally meritorious paper published during the year in the society's journals, has been awarded to Thomas Midgley, Jr., of the General Motors Corporation. Mr. Midgley's remarkable work in the development of anti-knock compounds for internal combustion engines is too well known to require elaboration here. The medal will be presented on March 9 by C. A. Browne, chairman of the New York Section, as Dr. Nichols, who was asked to make the presentation, will be in California at that time.

Wilder D. Bancroft, of Cornell, will also speak at this meeting, on Midgley and various aspects of his work. Mr. Midgley will review the effects of anti-knock compounds on gaseous detonation and then emphasize the fact that to all intents and purposes the anti-knock property is a new property of matter which can be truly ascribed to one element in the compound and that the groups bonded to this atom modify its behavior. His remarks will be illustrated with slides and be accompanied by experiments.

Industrial Alcohol Situation Improved, Says Doran

The industrial alcohol situation is in far better condition as regards denaturing of the product and its use illegally as liquor than it was a year ago, according to J. M. Doran, head of the industrial alcohol division of the prohibition unit, while reports to the division indicate that the legitimate industry is enjoying a period of prosperity with plants running to capacity.

Newspaper reports which were current shortly after the first of the year to the effect that much of the illicit liquor supply was due to industrial alcohol being misused were grossly exaggerated, according to Dr. Doran, who declared that the basis probably was a series of arrests and several suspensions of permits to consumers. These developments were the result of long work by the prohibition unit, Dr. Doran declared, and not connected with an influx of liquor during the holidays.

CONDITIONS UNDER CONTROL

The unit has been successful in cleaning out a number of fraudulent permittees who were securing industrial alcohol on the plea of need for manufacturing purposes but in reality for illegal use, Dr. Doran asserted, and has had close co-operation with industrial alcohol producers in this effort.

"From the prohibition standpoint, conditions a year ago were alarming but are now well under control," said Dr. Doran. "Progress has been surprisingly satisfactory and I never felt better about the situation than now."

Ceramic Society to Hold Silver Jubilee in Pittsburgh

Plans for General Session, Divisional Meetings and Plant Visits Reflect Endeavor to Surpass All Previous Efforts

Since the publication in our last issue of the program of the refractories division for the American Ceramic Society meeting at Pittsburgh, Feb. 12 to 16, announcement has been made of plans for the other divisional meetings, the general session and plant visits. The meeting will open with a general business and technical session in the ballroom of the William Penn Hotel, Monday, Feb. 12. That evening will be devoted to a banquet in honor of charter members. Industrial divisions will meet Tuesday and Wednesday at the Fort Pitt Hotel. Plant visits will be made Thursday and Friday. During the entire week an exhibition of ceramic products will be held at the Fort Pitt Hotel.

Although the program is still incomplete, the following excerpts will indicate the effort which is being exerted to make this meeting the best ever held.

GENERAL BUSINESS AND TECHNICAL SESSION

Presidential address, Frank H. Riddle.
Research—Its Relation to a Manufacturing Executive, B. E. Salisbury.
Theory and Practice in Refractories, J. D. Ramsey.
The Art of Manufacture and the Manufacture of Art, Charles F. Binns.
The Industrial Benefits From Co-operation in Research Through the Enamel Division, DeWitt F. Riese.
International Critical Tables of Numerical Data of Physics, Chemistry and Technology, E. W. Washburn.
A Simple Method of Measuring Color, A. E. O. Munsell.

ENAMEL DIVISION

A Cause of the "Specking" of Ground Coat Enamels, R. R. Danielson and T. D. Hartshorn.
Sand Blasting of Cast Iron for Enameling Purposes, F. G. Jaeger.
Relative Action of Acids on Enamels, E. P. Poste.
The Intermittent Type of Gas-Fired Enameling Furnaces, H. H. Clark.
A Study of Some Substitutes for Tin Oxide and Their Effect on Opacity, R. R. Danielson and M. K. Frehafer.
Zirconia in Enamels, W. F. Wenning.
Some Relations Between the "Fit" and the Mechanical and Chemical Properties of Enamelled Ware, R. R. Danielson and B. T. Sweely.
The Use of Bentonite for Suspending Enamels, M. E. Manson.
There will also be discussions on fuels and furnaces for enameling, use of silicon carbide refractories for enameling furnace muffles, transparent enamels, single coat gray enameled ware.

HEAVY CLAY PRODUCTS DIVISION

Experiences With Dutch Kilns, Roy A. Horning.
Construction Features of Importance to Clay Plants, T. W. Garve.
Wastes That Should Be Eliminated in Heavy Clay Products Manufacturing, M. W. Blair.
A Recent Installation of a Harrop Car Tunnel Kiln, Frank M. Hartford.
Automatic Stoker for Firing Heavy Clay Products Kilns, John Martin.
Some Calculations Involved in the Drying of Clay Wares, Hewitt Wilson.

GLASS DIVISION

Better Gas—Better Combustion—Better Begin, W. B. Chapman.
The Resistance of Soda Lime Glass to Water, L. A. Palmer.
A Study of the Tendency of Glass to Take Up Moisture, K. L. Ford.
The Advisability of Pure Research on Glass in American Universities, Alexander Silverman.

Resistance of Soda Lime Glass to Water, A. E. Williams.

Cold Clean Artificial Gas and a Discussion of the General Properties of Gaseous Fuels, A. E. Blake.

Furnaces for the Melting of Glass in the Laboratory, A. E. Badger and C. D. Spencer.
A Skiagraphic Study of Fabricated Glass Articles, C. D. Spencer and A. E. Badger.
Glass Wool Heat Insulation in Europe, Arthur D. Saborsky.

A Study of the Origin and Cause of Stones in Glass, Herbert E. Insley.

Results of Mechanical Tests on Window Plate and Rolled Sheet Glass, Arthur E. Williams.

Tensile Strength of Glass, J. T. Littleton.

TERRA COTTA DIVISION

Mold Shop Practices, T. A. Klinefelter.
Monograph of Ceramic Literature on Terra Cotta Subjects, Hewitt Wilson.

A Study of a Group of Slip Clays of the United States, Paul E. Cox and Mark A. Taylor.

Various Materials Used for Patching Terra Cotta, C. W. Hill.

Tests Used for Barytes in Terra Cotta Work, W. L. Howatt.

Scheduling in Terra Cotta Plant, Pensyl Mawby.

A Group of Slip Clays of the United States, Paul E. Cox and Mark A. Taylor.
Magnesium Chloride Cements, C. R. Hill.
Dow Chemical Co.

WHITE WARES DIVISION

A Better Design for a Jug Mold Clinch, Paul E. Cox.

A Study of Plasticity with Practical Potters' Methods, Paul E. Cox and D. A. Moulton.

Recent Developments in Control and Operation of Modern Kilns, T. A. Jeffrey, L. E. Jeffrey and T. R. Harrison.

Further Studies of Porcelain Glazes Maturing at High Temperatures, Robert Twells, Jr.

Preliminary Experiments in Use of American Ball Clays in General Ware Bodies, F. K. Pence.

Heat Distribution of the Updraft Kiln, Albert V. Bleininger.

Colloquium on Feldspar, led by Edward Schramm.

Colloquium on Saggers, led by Walter A. Hull.

ART DIVISION

Papers on subjects outlined as chapters of a book on modern pottery practice will form a large part of the Art Division program. In addition, however there will be numerous papers on related topics.

PLANT VISITS

Plants to be visited have been divided into seven groups, members having a choice of four trips (1 to 4 below) on Thursday, Feb. 15, and three trips on Friday, Feb. 16.

Trip 1—Fallston Fire Clay Co., Fallston, Pa.; H. C. Fry Glass Co., Beaver Falls Art Tile Co., Mayer China Co., all at Beaver Falls, Pa.

Trip 2—American Window Glass Co., Arnold; Allegheny Plate Glass Co., Glassmere; Heidenkamp Plate Glass Co., Springdale.

Trip 3—Standard Sanitary Mfg. Co., Pittsburgh Clay Pot Co., U. S. Glass Co., Willets Co., Woods-Lloyd Co., Mellon Institute.

Trip 4—Clairton plant, Carnegie Steel Co.; Donora plant and zinc works of American Steel & Wire Co.

Trip 5—East Liverpool district. Homer Laughlin China Co., Golding & Son, plant 1; Hall China Co., R. Thomas & Sons Co.

Trip 6—National Works, National Tube Co., McKeesport; Harbison-Walker Refractories Co., Hays; by-product ovens, Jones & Laughlin Steel Co., Hazelwood.

Trip 7—Westinghouse Electric & Mfg. Co., Universal Portland Cement Co., Universal, or High Voltage Insulator Co., Derry.

Personal

C. F. BLUE, president and director of the Carbon Steel Co., Pittsburgh, Pa., has resigned.

C. D. GARRETSON, general manager and director of the Electric Hose & Rubber Co., Wilmington, Del., has been elected president of the company, succeeding GEORGE S. CAPELLE, who becomes chairman of the board of directors. Mr. Garretson has been connected with the company for 19 years.

R. S. GOSROW of Chicago has been engaged as electrometallurgist for the Manitoba Power Co., Ltd., and the Winnipeg Electric Railway Co., Winnipeg, Man.

BENJAMIN G. LAMME, chief engineer of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., was the recipient of the Joseph Sullivan medal from the Ohio State University, Jan. 12, his alma mater, which he received for notable engineering achievements.

A. M. MADDOCK, an official of Thomas Maddock's Sons Co., Trenton, N. J., manufacturer of sanitary ware, gave an interesting illustrated address on the subject of "Early Pottery and Its Development" before the Men's Association of the First Presbyterian Church, Trenton, Jan. 15.

CHARLES PIEZ, president of the Link-Belt Co., Chicago, addressed the annual meeting of the Engineers' Society of Western Pennsylvania, Pittsburgh, Jan. 22, on "Some Problems of the Day."

C. J. RAMSBURG, vice-president of the Koppers Co., Pittsburgh, addressed the Cleveland Section of the American Chemical Society, Jan. 26, on "Coke."

Dr. OWEN L. SHINN, professor of applied chemistry, University of Pennsylvania, will supervise a course of ten lectures on chemistry for the instruction of salesmen, to be given under the direction of the Chemical Club of Philadelphia, Pa.

L. J. TROESTEL, a member of the Bureau of Chemistry, dust explosion staff, has resigned to accept the position of chief chemist of the American Refractories Co. at the Joliet, Ill., plant. Mr. Troestel leaves Washington about the middle of February to assume his new work in Joliet.

R. C. WELLS spoke before the Chemical Society of Washington on Jan. 11, presenting his address as retiring president, on the subject, "Chemistry of the Sea."

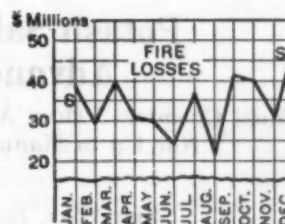
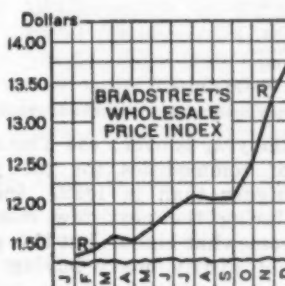
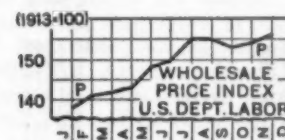
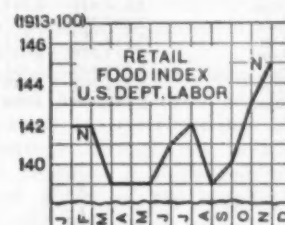
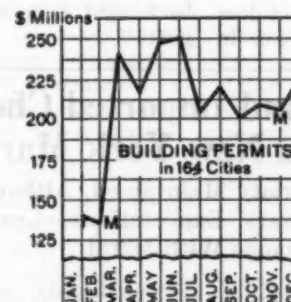
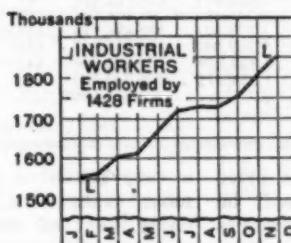
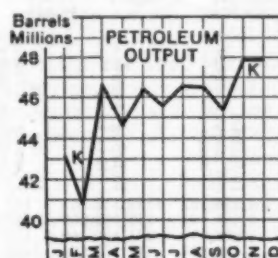
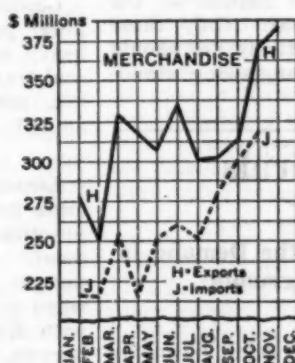
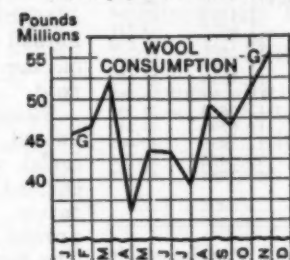
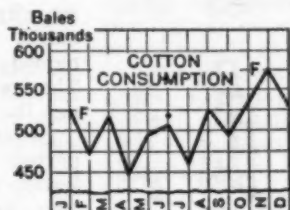
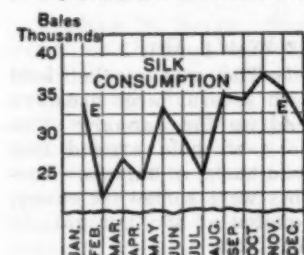
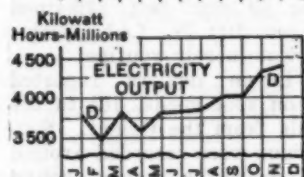
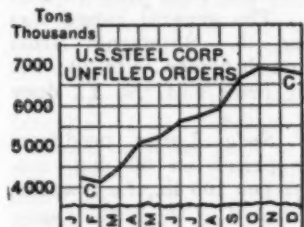
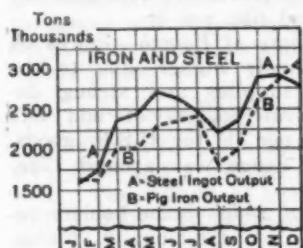
The American Chemical Society, Louisville Section, has elected the following officers: C. E. BALES, chemist of Louisville Fire Brick Works, president; T. J. BOSMAN, of the Federal Chemical Co., vice-president; C. E. GEIGER, of the Louisville Testing Laboratory, secretary-treasurer, and A. W. HOMBERGER, of the University of Louisville, councilor.

Market Conditions

In Chemical, Metallurgical and Allied Industries

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities
Prevailing Prices and Market Letters From Principal Industrial Centers

ECONOMIC REVIEW OF 1922



THE TREND OF PRODUCTION AND CONSUMPTION DURING 1922

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Economic Review of 1922

Summary of Production, Consumption and Prices in the Country's Basic Industries

STATISTICAL evidence is now available definitely to confirm the earlier predictions that 1922 was a year of business expansion. Practically all of the great basic industries showed astonishing improvement during the 12 months ended Dec. 31, 1922. Not only has the volume of output measurably increased, but sales and prices have bettered considerably. Of the sixteen economic factors which form the basis of a business review of 1922, published in the January bulletin of the Irving Bank (see accompanying tables and charts) fifteen showed improvement in December (or last available month), as compared with the beginning of the year. Silk consumption alone was less in December than in January. The improvement ranged between 0.19 per cent in the case of cotton consumption and 87.5 in the output of pig iron.

Action and Reaction in Business

Readjustments Will Continue Until Overexpansion Period Is Balanced
—Babson Predicts Possibilities of Early Reaction

According to the cyclic theory of business, action and reaction must be approximately equal—in other words, depression in business must be followed by compensating activity, and *vice versa*. With this theory in mind, it is of interest to consider the question which is so often heard of late: Are we approaching a period of inflation? It would appear the present period of readjustment must be continued until it has compensated for the preceding period of overexpansion. Boom times will not come again until the reaction from the orgy of 1920 is completed.

In forecasting the trend in the commodity situation during 1923, the statistical organization headed by Roger Babson has recently stated that there

are possibilities, at least, for an early reaction and a temporary setback in present activity. The statement is as follows:

"The main points in the commodity situation for 1923 are (1) The upward swing will lose momentum, reaching a peak in early 1923; (2) There is a strong possibility of a reaction before

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	175.15
Last week	174.21
January, 1922	144
January, 1921	181
January, 1920	242
April, 1918 (high)	286
April, 1921 (low)	140

As cottonseed oil continued to rise in price it has favorably affected the index number, which showed a gain during the week of practically one point. The strength shown by caustic potash and the carbonate was sufficient to offset the effects of lower prices for caustic soda and acetic acid.

TABLE I—STATISTICS OF PRODUCTION, CONSUMPTION AND PRICES IN BASIC INDUSTRIES

	Steel Ingots, Out-put (Tons)	Pig Iron Output (Tons)	Unfilled Orders U. S. Steel End of Month (Tons)	Electricity Out-put Kw. Hr. (Thousands)	Silk Consumption (Bales)	Cotton Consumption (Bales)	Wool Consumption (Thousands of Lbs.)	Merchandise Exports (Thousands of Dollars)
Jan.	1,593,482	1,644,951	4,241,678	3,805,748	33,842	526,552	45,711	\$278,848
Feb.	1,745,022	1,629,991	4,141,069	3,467,846	22,107	473,073	46,492	250,620
Mar.	2,370,751	2,035,920	4,494,148	3,820,812	26,651	518,450	52,361	330,327
Apr.	2,444,513	2,072,114	5,096,917	3,596,520	24,247	446,843	36,048	318,462
May	2,711,141	2,306,679	5,254,228	3,823,591	33,284	495,674	43,602	307,569
June	2,634,477	2,361,028	5,635,531	3,835,430	29,529	507,869	43,519	335,117
July	2,487,104	2,405,365	5,776,161	3,871,324	24,996	458,875	39,332	301,250
Aug.	2,214,582	1,816,170	5,950,105	4,074,908	34,772	527,404	49,128	301,805
Sept.	2,373,779	2,033,720	6,691,607	4,049,204	34,212	495,344	46,777	313,093
Oct.	2,872,415	2,637,844	6,902,287	4,329,906	37,471	533,950	51,176	370,720
Nov.	2,889,297	2,849,703	6,840,242	4,398,595	35,467	577,561	55,362	383,000
Dec.	2,779,890	3,086,298	6,745,703		31,042	527,945		

	Merchandise Imports (Thousands of Dollars)	Petroleum Out-put (Thousands of Bbl.)	Industrial Workers (in 1428 Firms)	Building Permits (164 Cities)	U. S. Dept. of Labor Retail Price Index	U. S. Dept. of Labor Wholesale Price Index	Bradstreet's Wholesale Index First of Month	First Losses (Thousands of Dollars)
Jan.	\$217,185	43,141	1,556,507	\$140,517,763	142	138	\$11,3725	\$38,663
Feb.	215,743	40,814	1,565,401	135,452,009	142	141	11,4190	29,304
Mar.	256,178	46,634	1,604,959	241,460,369	139	142	11,6001	39,911
Apr.	217,023	44,635	1,616,834	217,171,601	139	143	11,5317	31,010
May	252,817	46,456	1,668,988	247,722,281	139	148	11,7044	29,869
June	260,461	45,559	1,722,371	250,172,411	141	150	11,9039	24,103
July	251,773	46,593	1,729,805	205,244,105	142	155	12,1069	36,668
Aug.	281,412	46,521	1,728,424	220,456,973	139	155	12,0688	21,580
Sept.	301,000	45,291	1,757,092	200,588,817	140	153	12,0793	41,515
Oct.	319,000	47,885	1,809,959	209,070,208	143	154	12,5039	40,065
Nov.		47,889	1,854,612	206,345,905	145	156	13,3482	30,776
Dec.				224,859,090*			13,7835	47,426

* 153 Cities.

the year is over; (3) The average price of commodities for the year will be higher than in 1922. Index numbers during the next few months may be somewhat higher, but this prospect does not justify heavy buying. We are in

a very sensitive period. Purchases in most cases should be limited to the early part of this year. Only those products that are relatively low should be bought from the long-swing standpoint."

Potash Salts and Imported Chemicals Advance in New York Market

Most Chemical Prices Are Firmly Maintained, Although the Demand Is Not Up to Manufacturers' Expectations—Lead Pigments Advance With Metal

NEW YORK, Jan. 29, 1923.

THE European disturbances are already reflected in the New York market and practically all imported chemicals are in a much firmer position than a week ago. In addition the negotiations of the German potash syndicate have tended to direct interest toward the potash salts. As a result caustic potash, the carbonate, permanganate and perchlorate are being quoted at higher prices on the spot market and stocks are none too plentiful.

Arsenic continues to be scarce and prices are correspondingly high. Caustic soda recorded a fractional decline for export, due presumably to competition from England. Imported lots of barium chloride were slightly lower on spot. Bichromates were in moderate demand, with supplies limited. Sal ammoniac was quite difficult to locate in round lots and holders are firm in their belief that prices are due for a sharp advance.

All lead pigments recorded increases due to the sharp rise in the metal. Standard, dry, white lead was quoted at 9½c. per lb., in casks, carload basis.

Formaldehyde, oxalic acid, bleaching powder, nitrite of soda and prussiate of potash continued along moderate active lines, with practically no change of importance recorded. Camphor was quoted lower, due to recent heavy arrivals from Japan.

HIGH-SPOTS IN THE MARKET

Arsenic—Several fair-sized sales were reported at 15½c. per lb. Nearby shipments were quoted at 15@15½c. per lb.

Barium Chloride—A few lots of imported material were offered somewhat lower on spot at \$90 per ton. The general range, however, was around \$95@ \$100 per ton. The demand continued moderately active.

Carbonate of Potash—Leading sellers quoted higher prices on all grades of imported goods. The 80-85 per cent calcined on spot sold at 6c. per lb., with the 96-98 per cent at 7½c. per lb.

Caustic Potash—Higher quotations for 88-92 per cent imported were recorded. Demand continues very active with large interests quoting as high as 7½c. per lb. The general range is around 7@7½c. per lb.

Caustic Soda—There has been very little demand for export and prices were lower around \$3.40@\$3.50 per 100 lb., f.a.s. Spot goods for domestic consumption was quite limited, with odd lots sold at \$3.75 per 100 lb., ex-store. Contracts at the works remained unchanged.

Chlorate of Potash—Spot quotations remained very firm in sympathy with the general strength of other potassium salts. Importers named 7½c. per lb. for crystal and powdered, with domestic figures around 8½c. per lb.

Permanganate of Potash—Prices on spot are sharply higher, due to the scarcity of supplies and strong demand. Several holders of odd lots named 17½c. per lb. for U.S.P. goods. The general range was around 17½c. per lb.

Prussiate of Soda—Some holders reported sales at fractionally higher levels, while others were still quoting 18½c. per lb. The general range was 18½@19c. per lb. Shipments from abroad were much firmer, with 20c. per lb. the lowest price c.i.f. N. Y., duty paid.

Silicate of Soda—Large producers quoted lower prices on 60 deg. material, with \$2 per 100 lb., f.o.b. works, carload basis heard as the regular quotation. The 40 deg. test remained around 80c. per 100 lb., f.o.b. works. The demand was merely routine.

Camphor—Large dealers reported lower prices on spot goods, due to the heavy arrivals from the Orient. Several transactions were recorded around 86c. per lb., with the range around 86@87c. per lb.

VEGETABLE OILS

Linseed Oil—The spot market held quite firm, with several large crushers practically sold up for January shipment. January oil held around 90c. per gal., carload basis, in barrels. Forward shipments were somewhat easier, with March quoted at 85c. per gal., in barrels, carload lots.

Castor Oil—There was very little change in prices recorded during the interval, although the market showed a very firm appearance. Producers quoted AA grade at 12½c. per lb., with No. 3 at 12½c. per lb., carload lots, in barrels.

China Wood Oil—The spot market ruled quite firm and prices were advanced to 18c. per lb., a new high level for the past year. Supplies abroad were reported quite scarce and leading dealers are looking forward to a much higher market. March-April-May shipments from China were quoted at 15c. per lb.

Coconut Oil—Although demand was rather dormant, prices ruled steady throughout the week. Ceylon type oil held around 8½c. per lb., sellers' tanks, prompt shipment. Spot oil in barrels was quoted around 9½c. per lb.

Soya Bean Oil—A fair-sized tonnage of crude material was reported sold at 10½c. per lb., tanks, f.o.b. New York. Spot oil in tanks was quoted around 10½c. per lb. The general inquiry was only moderate.

More Activity With Firmer Market at St. Louis

Very Few Price Declines as Volume of Trading Shows Material Increase—Glycerine Market Unsettled

ST. LOUIS, Mo., Jan. 24, 1923.

Since our last report a material increase in the volume of business transacted is to be reported and future prospects are very encouraging. Prices generally are firm. The European disturbances will undoubtedly reflect upon the American market and bring about higher prices.

ALKALIS HOLDING WELL

Conditions in the alkali market are very firm and prices are still holding well. The volume of business is good with a chance of increasing from now on. *Caustic soda* in 5-drum lots is being quoted at \$3.90 per 100 lb. for the solid and \$4.25 for the flake, delivered buyer's door. *Soda ash*, 58 per cent light in 5-bag lots can be had at \$2.10 per 100 lb., with the regular differential of 20c. for barrels over bags. Carload business goes at about \$1.85 per 100 lb. *Sodium bicarbonate* in small lots from 3 to 5 bbl. is going strong at \$2.40 per 100 lb., and some sales are being made as high as \$2.50. *Sal soda* has not held its own with the other alkalis and the volume of sales is not as large as could be expected. However, it is expected that sal soda will be higher soon.

GENERAL AND SPECIAL CHEMICALS

Trading in heavy *mineral acids* is exceptionally good, also showing a material increase in volume and the market is much firmer. Stocks of *citric acid* are in good volume, but the demand only along quiet lines. *Oxalic acid* manages to hold its own. *Ammonia water* 26 deg. is showing some improvement and a very satisfactory business is being done. *White arsenic* continues to be very scarce. The demand for *carbon bisulphide* continues to improve and a very nice business is reported on this article. *Copperas* is moving in a routine manner and the market remains unchanged, with supplies somewhat easier. *Glycerine* is very unsettled and apparently no one knows just what the market is. Prices range from 17½¢ to 18½¢ lb. Contracts are being made at various prices and spot goods also are being sold at various prices. A settled market is now in sight. *Lead acetate* has advanced recently, but the demand is rather quiet; however, this article should show more activity very soon. *Sulphur* is moving along in rather a routine manner. The volume of sales is only moderate and prices are not over strong. Sales are beginning to pick up slightly, but are not yet what they should be. *Zinc spelter*, while quiet, is still moving in fair volume. This also is the case with *zinc dust*. Both have been very firm and a change in price is not looked for very soon. *Zinc sulphate* is in very good demand and quoted in carload lots

at 3½¢ f.o.b. St. Louis, and less than carload lots at 3¼¢ f.o.b. St. Louis.

OILS AND PAINT MATERIALS

Castor oil has taken a very stiff increase and has now reached 14c. a lb. in drums. It may go higher and manufacturers are frank to admit that the market is tending that way. *Turpentine* has again gone skyrocketing and touched \$1.67 per gal. in single barrels and \$1.61 in 5-bbl. lots—quite an increase from when we last reported. *Linseed oil* is holding firm and the demand is very good. Higher prices are almost inevitable and users are purchasing as much as possible while prices remain at the present level.

Paint grinders are optimistic for the coming season and are buying freely. Several carloads of dry-earth colors have been purchased for shipment via New Orleans.

Buoyant Tendency Seen in Steel Market

Infrequent Price Advances Noted as General Activity Shows Marked Increase

PITTSBURGH, Jan. 26, 1923.

The general tone of the steel market has further improved in the past week. There has been continuous improvement since early in December. The market has indeed now come to display a buoyant tendency, since there is now a liberal sprinkling of price advances, whereas in November the average mill would probably have been well satisfied with a guarantee of continuance of the prices then existing, some of which were being shaded not infrequently.

MANY PRICE ADVANCES

Hoops, formerly quotable at a range of 2.75¢ to 2.90c. according to gage and other conditions, are now at 2.90c. as minimum, with some unattractive orders going as high as 3.25c. For a time there were sales, to particularly favorite buyers, at 2.60c. and even 2.50c.

Technically, merchant steel bars are quotable at 2¢ to 2.10c., but the 2c. price seems to be for rather late and uncertain delivery or to apply on special contracts, as for steel involved in large fabricated steel contracts. In November the top of the market was 2c., with various concessions.

Wrought-iron pipe has been advanced four to six points, according to size, on black, and two points extra on galvanized, while double extra strong is advanced six to ten points, uniformly on black and galvanized.

The National Tube Co. has issued a new list on welded steel boiler tubes, dated Jan. 23, decreasing discounts by three points on all sizes except 1½ in., which is unchanged. The new basing discount is 48 per cent on less than carloads, making 52 per cent on carloads. The advance is followed by all independents. Producers have been well sold up for some time past.

An advance in merchant steel pipe

and oil country goods is expected at any time and in some quarters is regarded as overdue, considering the sold up condition of mills and the pressure for deliveries.

The American Steel & Wire Co., while not following the recent advance of independent mills of \$2 a ton on plain wire and 10c. a keg on nails, has adopted new extras, annealing plain wire being \$3 a ton extra, while the basis for galvanizing is increased from 50c. to 60c. a hundred pounds on the base gages and additional advances are made for other gages.

An important point in the general price situation is that the United States Steel Corporation is participating in the price advances, though not in all cases. Until recently it appeared to be the general policy of the corporation to avoid any advance at all.

Independent sheet mills are now sold up much better than they were at the beginning of December, several being very well filled to April 1, beyond which date they are indisposed to obligate themselves. The advance recently predicted is likely to occur for second quarter, and will probably be \$3 a ton, to 3.50c. for black sheets and 4.50c. for galvanized sheets. The Steel Corporation is not a feature in this situation, since it is already sold up into June at the prices ruling for months past.

COKE AND PIG IRON

Since about the first of the year the common expectation has been that arrangements would be made removing the possibility of a bituminous coal strike April 1. The actual agreement has been signed in the past week. In December the prevailing opinion was that there would be a mining suspension, and part of the steel demand then running was supposed to be an anticipation of that mining suspension. The altered condition, however, does not seem to have affected steel demand adversely.

The Connellsville coke market has not weakened on account of the change in labor outlook, prices being sustained largely by there being a continued scattered demand for heating coke, amounting to a fair volume altogether, with occasional inquiry from blast furnaces on account of delayed deliveries on contracts. The market is \$8@8.25 on furnace coke and \$9.25@9.50 on foundry coke, with a possibility that \$8.50 might have to be paid, in an emergency, for the best furnace coke.

The pig iron market continues decidedly sluggish, on the whole, as to new buying, but furnaces seem to be fairly well sold up, while consumers are taking full deliveries and in some cases endeavoring to anticipate. Consumers are evidently in expectation that prices are much more likely to be lower than higher in the near future, on the ground that coke can hardly avoid declining. The market is quotable at \$27.50 for bessemer, \$25@26 for basic and \$27@28 for foundry, f.o.b. valley furnaces, freight to Pittsburgh being \$1.77.

Current Prices in the New York Market

FOR CHEMICALS, OILS AND ALLIED PRODUCTS

Although these prices are for the spot market in New York City, a special effort has been made to report the American manufacturer's quotations whenever available. In many instances these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported and resale stocks are reported when of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetic anhydride, 85%, drums	lb.	\$0.39 - \$0.41
Acetone, drums	lb.	.21 - .21
Acid, acetic, 28%, bbl.	100 lb.	3.25 - 3.50
Acetic, 56%, bbl.	100 lb.	6.50 - 6.75
Glacial, 99%, carboys	100 lb.	12.00 - 12.50
Boric, crystals, bbl.	lb.	.11 - .11
Boric, powder, bbl.	lb.	.11 - .11
Citric, kegs	lb.	.49 - .50
Formic, 85%	lb.	.18 - .19
Gallie, tech.	lb.	.45 - .50
Hydrochloric, 18% tanks	100 lb.	.80 - 1.00
Hydrofluoric, 52%, carboys	lb.	.12 - .12
Lactic, 44%, tech., light, bbl.	lb.	.11 - .11
22% tech., light, bbl.	lb.	.05 - .05
Muriatic, 20% tanks	100 lb.	1.00 - 1.10
Nitric, 36%, carboys	lb.	.04 - .05
Nitric, 42%, carboys	lb.	.06 - .06
Oleum, 20% tanks	ton	17.00 - 18.00
Oxalic, crystals, bbl.	lb.	.12 - .13
Phosphoric, 50%, carboys	lb.	.08 - .09
Pyrogallol, resublimed	lb.	1.50 - 1.60
Sulphuric, 60%, tanks	ton	9.00 - 10.00
Sulphuric, 60%, drums	ton	12.00 - 14.00
Sulphuric, 66%, tanks	ton	14.50 - 15.00
Sulphuric, 66%, drums	ton	19.00 - 20.00
Tannic, U.S.P., bbl.	lb.	.65 - .75
Tannic, tech.	lb.	.40 - .45
Tartaric, imp. crys., bbl.	lb.	.30 - .31
Tartaric, imp., powd., bbl.	lb.	.31 - .32
Tartaric, domestic, bbl.	lb.	.32 - .32
Tungstic, per lb. of WO ₃	lb.	1.00 - 1.20
Alcohol, butyl, drums	gal.	.18 - .23
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.75 - 4.95
Alcohol, methyl (see Methanol)		
Alcohol, denatured, 180 proof No. 1	gal.	.39 - .41
Alum, ammoniac, imp., bbl.	lb.	.03 - .03
Potash, lump, bbl.	lb.	.03 - .03
Chrome, lump, potash, bbl.	lb.	.05 - .05
Aluminum sulphate, com. bags	100 lb.	1.50 - 1.65
Iron free bags	lb.	.02 - .02
Aqua ammonia, 26%, drums	lb.	.06 - .07
Ammonia, anhydrous, cyl.	lb.	.30 - .30
Ammonium carbonate, powd. casks	lb.	.09 - .09
Ammonium nitrate, tech. casks	lb.	.10 - .11
Amyl acetate tech., drums	gal.	2.80 - 3.05
Arsenic, white, powd., bbl.	lb.	.15 - .15
Arsenic, red, powd., kegs	lb.	.13 - .13
Barium carbonate, bbl.	ton	75.00 - 77.00
Barium chloride, bbl.	ton	90.00 - 100.00
Barium dihydrate, drums	lb.	.18 - .18
Barium nitrate, casks	lb.	.08 - .08
Barium sulphate, bbl.	lb.	.04 - .04
Blanc fixe, dry, bbl.	lb.	.04 - .04
Blanc fixe, pulp, bbl.	ton	45.00 - 55.00
Bleaching powder, f.o.b. wks. drums	100 lb.	2.00 - 2.50
Resale drums	100 lb.	2.25 - 2.50
Borax, bbl.	lb.	.05 - .05
Bromine, cases	lb.	.27 - .28
Calcium acetate, bags	100 lb.	3.50 - 3.60
Calcium carbide, drums	lb.	.04 - .04
Calcium chloride, fused, drums	ton	22.00 - 23.00
Gran. drums	lb.	.01 - .01
Calcium phosphate, mono, bbl.	lb.	.06 - .07
Camphor, cases	lb.	.86 - .88
Carbon bisulphide, drums	lb.	.07 - .07
Carbon tetrachloride, drums	lb.	.10 - .10
Chalk, precip.—domestic, light, bbl.	lb.	.04 - .04
Domestic, heavy, bbl.	lb.	.03 - .03
Imported, light, bbl.	lb.	.04 - .05
Chlorine, liquid, cylinders	lb.	.06 - .06
Chloroform, tech., drums	lb.	.35 - .38
Cobalt oxide, bbl.	lb.	2.10 - 2.25
Copperas, bulk, f.o.b. wks.	ton	20.00 - 22.00
Copper carbonate, bbl.	lb.	.20 - .20
Copper cyanide, drums	lb.	.50 - .55
Coppersulphate, crys., bbl.	100 lb.	6.00 - 6.25
Cream of tartar, bbl.	lb.	.25 - .26
Dextrine, corn, bags	100 lb.	3.25 - 3.50
Epsom salt, dom., tech. bbl.	100 lb.	2.10 - 2.25
Epsom salt, imp., tech. bags	100 lb.	1.10 - 1.25
Epsom salt, U.S.P., dom. bbl.	100 lb.	2.50 - 2.75
Ether, U.S.P., drums	lb.	.13 - .15
Ethyl acetate, com., 85%, drums	gal.	.80 - .85
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	.95 - 1.00
Formaldehyde, 40%, bbl.	lb.	.16 - .16

Fullers earth, f.o.b. mines	net ton	\$16.00 - \$17.00
Fullers earth—imp., powd., net ton		30.00 - 32.00
Fusel oil, ref., drums	gal.	3.55 - 4.05
Fusel oil, crude, drums	gal.	2.30 - 2.40
Glauber's salt, wks., bags	100 lb.	1.20 - 1.40
Glauber's salt, imp., bags	100 lb.	1.00 - 1.25
Glycerine, c.p., drums extra	lb.	.18 - .19
Glycerine, dynamite, drums	lb.	.17 - .17
Iodine, resublimed	lb.	4.50 - 4.60
Iron oxide, red, casks	lb.	.12 - .18

Lead:		
White, basic carbonate, dry, casks	lb.	.09 - .10
White, in oil, kegs	lb.	.12 - .13
Red, dry, casks	lb.	.11 - .11
Red, in oil, kegs	lb.	.13 - .14
Lead acetate, white crys., bbl.	lb.	.13 - .13
Lead arsenate, powd., bbl.	lb.	.21 - .22
Lime-Hydrated, bbl.	per ton	16.80 - 17.00
Lime, Lump, bbl.	280 lb.	3.63 - 3.65
Litharge, comm., casks	lb.	.09 - .10
Lithophone, bbl.	lb.	.06 - .07
Magnesium carb., tech., bags	lb.	.07 - .07
Methanol, 95%, bbl.	gal.	1.23 - 1.25
Methanol, 97%, bbl.	gal.	1.25 - 1.27
Nickel salt, double, bbl.	lb.	.10 - .10
Nickel salts, single, bbl.	lb.	.11 - .11
Phosgene		.60 - .75
Phosphorus, red, cases	lb.	.35 - .40
Phosphorus, yellow, cases	lb.	.30 - .35
Potassium bichromate, casks	lb.	.10 - .10
Potassium bromide, gran., bbl.	lb.	.20 - .27
Potassium carbonate, 80-85%, calcined, casks	lb.	.06 - .06
Potassium chlorate, powd.	lb.	.07 - .08
Potassium cyanide, drums	lb.	.47 - .80
Potassium hydroxide (caustic potash) drums	100 lb.	7.25 - 7.50
Potassium iodide, cases	lb.	3.60 - 3.70
Potassium nitrate, bbl.	lb.	.06 - .07
Potassium permanganate, drums	lb.	.17 - .18
Potassium prussiate, red, casks	lb.	.85 - .90
Potassium prussiate, yellow, casks	lb.	.38 - .39
Salammoniac, white, gran., casks	lb.	.06 - .06
Gray, gran., casks	lb.	.08 - .08
Sala soda, bbl.	100 lb.	1.20 - 1.40
Salt cake (bulk)	ton	25.00 - 27.00
Soda ash, light, 50% flat, bags, contract, f.o.b.	100 lb.	1.60 - 1.67
Soda ash, light, basis, 48%, wks., contract, f.o.b.	100 lb.	1.20 - 1.30
Soda ash, light, 58% flat, bags, resale	100 lb.	1.75 - 1.80
Soda ash, dense, bags, contract, basis 48%	100 lb.	1.17 - 1.20
Soda ash, dense, in bags, resale	100 lb.	1.85 - 1.90
Soda, caustic, 76%, solid, drums, f.a.s.	100 lb.	3.40 - 3.60
Soda, caustic, 76%, solid, drums, contract	100 lb.	3.35 - 3.40
Soda, caustic, basis 60%, wks., contract	100 lb.	2.50 - 2.60
Soda, caustic, ground and flake, contracts	100 lb.	3.80 - 3.90
Soda, caustic, ground and flake, resale	100 lb.	4.00 - 4.15
Sodium acetate, works, bags	lb.	.06 - .07
Sodium bicarbonate, bbl.	100 lb.	1.75 - 1.85
Sodium bichromate, casks	lb.	.07 - .08
Sodium bisulphate (niter cake)	ton	6.00 - 7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04 - .04
Sodium chlorate, kegs	lb.	.06 - .07
Sodium chloride, long ton	ton	12.00 - 13.00
Sodium cyanide, cases	lb.	.19 - .23
Sodium fluoride, bbl.	lb.	.09 - .10
Sodium hypsulphite, bbl.	lb.	.03 - .03
Sodium nitrite, casks	lb.	.08 - .09
Sodium peroxide, powd., cases	lb.	.28 - .30
Sodium phosphate, dibasic, bbl.	lb.	.03 - .04
Sodium prussiate, yel. drums	lb.	.19 - .19
Sodium silicate (40% drums)	100 lb.	.80 - 1.15
Sodium silicate (60% drums)	100 lb.	2.00 - 2.25
Sodium sulphide, fused, 60-62% drums	lb.	.04 - .04
Sodium sulphite, crys., bbl.	lb.	.03 - .03
Strontium nitrate, powd., bbl.	lb.	.09 - .10
Sulphur chloride, yel. drums	lb.	.04 - .05
Sulphur, crude	ton	18.00 - 20.00
Sulphur dioxide, liquid, cyl.	lb.	.08 - .08
Sulphur, flour, bbl.	100 lb.	2.50 - 3.15
Sulphur, roll, bbl.	100 lb.	2.15 - 2.20

Tale—imported, bags	ton	\$30.00 - \$40.00
Tale—domestic powd., bags	ton	18.00 - 25.00
Tin bichloride, bbl.	lb.	.11 - .11
Tin oxide, bbl.	lb.	.45 - .47
Zinc carbonate, bags	lb.	.14 - .14
Zinc chloride, gran, bbl.	lb.	.07 - .07
Zinc cyanide, drums	lb.	.42 - .44
Zinc oxide, XX, bbl.	lb.	.07 - .08
Zinc sulphate, bbl.	100 lb.	2.75 - 3.00

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	.95 - \$1.00
Alpha-naphthol, ref., bbl.	lb.	1.05 - 1.10
Alpha-naphthylamine, bbl.	lb.	.28 - .30
Aniline oil, drums	lb.	.16 - .17
Aniline salts, bbl.	lb.	.24 - .25
Anthracene, 80%, drums	lb.	.75 - 1.00
Anthracene, 80%, imp., drums, duty paid	lb.	.65 - .70
Anthraquinone, 25%, paste, drums	lb.	.70 - .75
Benzaldehyde U.S.P., carboys	lb.	1.35 - 1.40
Benzene, pure, water-white, tanks and drums	gal.	.30 - .35
Benzene, 90%, drums	gal.	.26 - .32
Benzene, 90%, drums, resale	gal.	.32 - .34
Benzidine base, bbl.	lb.	.85 - .90
Benzidine sulphate, bbl.	lb.	.75 - .80
Benzoic acid, U.S.P. kegs	lb.	.72 - .75
Benzoate of soda, U.S.P., bbl.	lb.	.57 - .65
Benzyl chloride, 95-97%, ref., drums	lb.	.25 - .27
Benzyl chloride, tech., drums	lb.	.20 - .23
Beta-naphthol, subl., bbl.	lb.	.55 - .60
Beta-naphthol, tech., bbl.	lb.	.25 - .26
Beta-naphthylamine, tech.	lb.	1.00 - 1.25
Carbazol, bbl.	lb.	.75 - .90
Cresol, U.S.P., drums	lb.	.24 - .28
Ortho-cresol, drums	lb.	.26 - .26
Cresylic acid, 97%, resale, drums	gal.	1.25 - 1.30
95-97%, drums, resale	gal.	1.25 - 1.30
Dichlorobenzene, drums	lb.	.07 - .07
Diethylaniline, drums	lb.	.50 - .60
Dimethylaniline, drums	lb.	.39 - .41
Dinitrobenzene, bbl.	lb.	.20 - .22
Dinitrochlorobenzene, bbl.	lb.	.22 - .23
Dinitronaphthalene, bbl.	lb.	.30 - .32
Dinitrophenol, bbl.	lb.	.35 - .40
Dinitrotoluene, bbl.	lb.	.22 - .24
Dip oil, 25%, drums	gal.	.25 - .30
Diphenylamine, bbl.	lb.	.54 - .56
Hi-acid, bbl.	lb.	.75 - .80
Meta-phenylenediamine, bbl.	lb.	.95 - 1.00
Miehlers ketone, bbl.	lb.	3.50 - 3.75
Monochlorobenzene, drums	lb.	.08 - .10
Monoethylaniline, drums	lb.	.95 - 1.10
Naphthalene, crushed, bbl.	lb.	.05 - .06
Naphthalene, flake, bbl.	lb.	.06 - .06
Naphthalene, balls, bbl.	lb.	.07 - .07
Naphthionate of soda, bbl.	lb.	.58 - .65
Naphthionic acid, crude, bbl.	lb.	.60 - .65
Nitrobenzene, drums	lb.	.10 - .12
Nitro-naphthalene, bbl.	lb.	.30 - .35
Nitro-toluene, drums	lb.	.15 - .17
N-W acid, bbl.	lb.	1.20 - 1.30
Ortho-amidophenol, kegs	lb.	2.30 - 2.35
Ortho-dichlorobenzene, drums	lb.	.17 - .20
Ortho-nitrophenol, bbl.	lb.	.90 - .92
Ortho-nitrotoluene, drums	lb.	.12 - .14
Ortho-toluidine, bbl.	lb.	.14 - .16
Para-amidophenol, base, kegs	lb.	1.25 - 1.30
Para-amidophenol, HCl, kegs	lb.	1.30 - 1.35
Para-dichlorobenzene, bbl.	lb.	.17 - .20
Paranitraniline, bbl.	lb.	.75 - .80
Para-nitrotoluene, bbl.	lb.	.55 - .65
Para-phenylenediamine, bbl.	lb.	1.50 - 1.55
Para-toluidine, bbl.	lb.	.85 - .90
Phthalic anhydride, bbl.	lb.	.35 - .38
Phenol, U.S.P., drums	lb.	.35 - .37
Picric acid, bbl.	lb.	.20 - .22
Pyridine, dom., drums	gal.	nominal
Pyridine, imp., drums	gal.	3.00 - 3.10
Resorcinol, tech., kegs	gal.	1.50 - 1.55
Resorcinol, pure, kegs	lb.	2.00 - 2.10
R-salt, bbl.	lb.	.55 - .60
Salicylic acid, tech., bbl.	lb.	.40 - .42
Salicylic acid, U.S.P., bbl.	lb.	.45 - .47
Solvent naphtha, water-white, drums	gal.	.37 - .40
Crude, drums	gal.	.22 - .24
Sulphanilic acid, crude, bbl.	lb.	.20 - .22
Thiocarbamide, kegs	lb.	.35 - .38
Toluidine, kegs	lb.	1.20 - 1.30
Toluidine, mixed, kegs	lb.	.30 - .35
Toluene, tank cars	gal.	.35 - .37
Toluene, drums	gal.	.40 - .43
Xylenes, drums	lb.	.40 - .45
Xylene, pure, drums	gal.	.45 - .50
Xylene, com., drums	gal.	.40 - .42
Xylene, com., tanks	gal.	.30 - .35

Naval Stores

Rosin B-D, bbl.	280 lb.	\$6.15	.....
Rosin E-I, bbl.	280 lb.	6.30	.....
Rosin K-N, bbl.	280 lb.	6.50	\$6.75
Rosin W-G-W-W, bbl.	280 lb.	7.75	8.25
Wood rosin, bbl.	280 lb.	6.25	.....
Turpentine, spirits of, bbl.	gal.	1.51	1.52
Wood, steam dist., bbl.	gal.	1.35	.....
Wood, dest. dist., bbl.	gal.	1.25	.....
Pine tar pitch, bbl.	200 lb.	.....	6.00
Tar, kiln burned, bbl.	500 lb.	.....	12.50
Retort tar, bbl.	500 lb.	.....	11.00
Rosin oil, first run, bbl.	gal.	.43	.....
Rosin oil, second run, bbl.	gal.	.47	.....
Rosin oil, third run, bbl.	gal.	.53	.....
Pine oil, steam dist.	gal.	.....	.90
Pine oil, pure, dest. dist.	gal.	.....	.85
Pine tar oil, ref.	gal.	.....	.46
Pine tar oil, crude, tanks	gal.	.....	35
f.o.b. Jacksonville, Fla.	gal.	.....	.75
Pine tar oil, double ref., bbl.	gal.	.....	.75
Pine tar, ref., thin, bbl.	gal.	.....	.52
Pinewood creosote, ref., bbl.	gal.	.....	.52

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	\$1.12	\$1.12
Castor oil, AA, bbl.	lb.	.12	.13
Chinawood oil, bbl.	lb.	.17	.17
Cocunut oil, Ceylon, bbl.	lb.	.091	.10
Cocunut oil, Cochinchina, bbl.	lb.	.10	.10
Corn oil, crude, bbl.	lb.	.11	.11
Cottonseed oil, crude (f.o.b. mill), tanks.	lb.	.10	.....
Summer yellow, bbl.	lb.	.12	.12
Winter yellow, bbl.	lb.	.13	.13
Lineed oil, raw, car lots, bbl.	gal.	.90	.91
Raw, tank cars (dom.), bbl.	gal.	.86	.87
Boiled, 5-bbl. lots (dom.), bbl.	gal.	.95	.96
Olive oil, denatured, bbl.	gal.	1.10	1.15
Palm, Lagos, casks, bbl.	lb.	.08	.08
Palm kernel, bbl.	lb.	.081	.09
Peanut oil, crude, tanks (mill), bbl.	lb.	.13	.14
Peanut oil, refined, bbl.	lb.	.16	.16
Rapeseed oil, refined, bbl.	gal.	.86	.87
Rapeseed oil, blown, bbl.	gal.	.90	.91
Soya bean (Manchurian), bbl.	lb.	.11	.....
Tank, f.o.b. Pacific coast.	lb.	.091	.....

Fish Oils

Menhaden, light pressed, bbl.	gal.	\$0.60	.....
White bleached, bbl.	gal.	.64	.65
Blown, bbl.	gal.	.68	.69
Whale No. 1 crude, tanks, coast.	lb.	.06	.06

Dye & Tanning Materials

Divi-divi, bags.	ton	\$38.00	\$39.00
Fustic, sticks.	ton	30.00	35.00
Fustic, chips, bags.	lb.	.04	.05
Logwood, sticks.	ton	28.00	30.00
Logwood, chips, bags.	lb.	.021	.03
Sumac, leaves, Sicily, bags.	ton	65.00	.....
Sumac, ground, bags.	ton	55.00	60.00
Sumac, domestic, bags.	ton	35.00	.....
Tapoca flour, bags.	lb.	.031	.05

EXTRACTS

Archil, conc., bbl.	lb.	\$0.17	\$0.18
Chestnut, 25% tannin, tanks.	lb.	.02	.03
Divi-divi, 25% tannin, bbl.	lb.	.04	.05
Fustic, crystals, bbl.	lb.	.20	.22
Fustic, liquid, 42% bbl.	lb.	.08	.09
Gambier, liq., 25% tannin, bbl.	lb.	.08	.09
Hematin, crys., bbl.	lb.	.14	.18
Hemlock, 25% tannin, bbl.	lb.	.04	.05
Hyperic, solid, drums.	lb.	.24	.26
Hyperic, liquid, 51% bbl.	lb.	.14	.17
Logwood, crys., bbl.	lb.	.19	.20
Logwood, liq., 51% bbl.	lb.	.09	.10
Quebracho, solid, 65% tannin, bbl.	lb.	.041	.05
Sumac, dom., 51% bbl.	lb.	.061	.07

Waxes

Bayberry, bbl.	lb.	\$0.28	\$0.30
Beeswax, refined, dark, bags.	lb.	.30	.32
Beeswax, refined, light, bags.	lb.	.34	.35
Beeswax, pure white, onses.	lb.	.40	.41
Candelilla, bags.	lb.	.34	.35
Carnauba, No. 1, bags.	lb.	.38	.40
No. 2, North Country, bags.	lb.	.23	.24
No. 3, North Country, bags.	lb.	.17	.18
Japan, cases.	lb.	.15	.15
Montan, crude, bags.	lb.	.031	.04
Paraffine, crude, match, 105-110 m.p.	lb.	.04	.04
Crude, seals 124-126 m.p., bags.	lb.	.021	.021
Ref., 118-120 m.p., bags.	lb.	.031	.031
Ref., 125 m.p., bags.	lb.	.031	.031
Ref., 128-130 m.p., bags.	lb.	.04	.04
Ref., 133-135 m.p., bags.	lb.	.041	.04
Ref., 135-137 m.p., bags.	lb.	.05	.05
Stearic acid, agle pressed, bags.	lb.	.10	.10
Double pressed, bags.	lb.	.10	.10
Triple pressed, bags.	lb.	.11	.11

Fertilizers

Ammonium sulphate, bulk, f.o.b. works.	100 lb.	\$3.20	\$3.25
F. a. s. double bags.	100 lb.	3.60	3.75
Blood, dried, bulk.	unit	4.60	.....
Bone, raw, 3 and 50, ground.	ton	30.00	35.00
Fish scrap, dom., dried, wks.	unit	5.00	5.10
Nitrate of soda, bags.	100 lb.	2.60	2.65
Tankage, high grade, f.o.b. Chicago.	unit	4.70	4.80

Phosphate rock, f.o.b. mines, Florida pebble, 68-72%.	ton	\$3.50	\$4.00
Tennessee, 78-80%.	ton	7.00	8.00
Potassium muriate, 80%, bags.	ton	35.55	38.25
Potassium sulphate, bags.	unit	1.00	.....

Crude Rubber

Para-Upriver fine.	lb.	\$0.34	\$0.35
Upriver coarse.	lb.	.28	.28
Upriver caucho ball.	lb.	.29	.30
Plantation—First latex crepe.	lb.	.35	.35
Ribbed smoked sheets.	lb.	.35	.35
Brown crepe, thin, clean.	lb.	.31	.32
Amber crepe No. 1.	lb.	.31	.32

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec.	sh. ton	\$450.00	\$550.00
Asbestos, shingle, f.o.b., Quebec.	sh. ton	60.00	80.00
Asbestos, cement, f.o.b., Quebec.	sh. ton	15.00	17.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	16.00	20.00
Barytes, grd., off-color, f.o.b. mills bulk.	net ton	13.00	21.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	24.00	28.00
Barytes, crude f.o.b. mines, bulk.	net ton	8.00	9.00
Casein, bbl., tech.	lb.	.12	.14
China clay (kaolin) crude, f.o.b. Ga.	net ton	7.00	9.00
Washed, f.o.b. Ga.	net ton	8.00	9.00
Powd., f.o.b. Ga.	net ton	14.00	20.00
Crude f.o.b. Va.	net ton	8.00	12.00
Ground, f.o.b. Va.	net ton	13.00	20.00
Imp., lump, bulk.	net ton	14.00	20.00
Imp., powd.	net ton	40.00	45.00
Feldspar, No. 1 pottery.	long ton	6.00	7.00
No. 2 pottery.	long ton	5.00	5.50
No. 1 soap.	long ton	7.00	7.50
No. 1 Canadian, f.o.b. mill.	long ton	20.00	21.00
Graphite, Ceylon, lump, first quality, bbl.	lb.	.05	.05
Ceylon, chip, bbl.	lb.	.04	.04
High grade amorphous crude.	ton	35.00	50.00
Gum arabic, amber, sorts, bags.	lb.	.15	.16
Gum tragacanth, sorts, bags.	lb.	.50	.60
No. 1, bags.	lb.	1.75	1.80
Kieselguhr, f.o.b. Cal.	ton	40.00	42.00
F.o.b. N. Y.	ton	50.00	55.00
Magnesite, crude, f.o.b. Cal.	ton	14.00	15.00
Pumice stone, imp., casks.	lb.	.03	.05
Dom., lump, bbl.	lb.	.05	.05
Dom., ground, bbl.	lb.	.06	.07
Shellac, orange fine, bags.	lb.	.84	.85
Orange superfine, bags.	lb.	.86	.87
A. C. garnet, bags.	lb.	.81	.82
T. N., bags.	lb.	.82	.83
Silica, glass sand, f.o.b. Ind.	ton	2.00	2.50
Silica, sand blast, f.o.b. Ind.	ton	2.50	5.00
Silica, amorphous, 250-mesh, f.o.b. Ill.	ton	17.00	17.50
Silica, bldg. sand, f.o.b. Pa.	ton	2.00	2.75
Soapstone, coarse, f.o.b. Vt., bags.	ton	7.00	8.00
Talc, 200 mesh, f.o.b. Vt., bags.	ton	6.50	9.00
Talc, 200 mesh, f.o.b. Ga., bags.	ton	7.00	9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags.	ton	16.00	20.00

Refractories

Bauxite brick, 56% Al ₂ O ₃ , f.o.b. Pittsburgh.	ton	\$45-50	.....
Chrome brick, f.o.b. Eastern shipping point.	ton	50-52	.....
Chrome cement, 40-50% Cr ₂ O ₃ , f.o.b. Eastern shipping points.	ton	23-27	.....
40-45% Cr ₂ O ₃ , sacks, f.o.b. Eastern shipping points.	ton	23.00	.....
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	40-46	.....
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	36-41	.....
Magnesite brick, 9-in. straight (f.o.b. wks.).	ton	65-68	.....
9-in. arches, wedges and keys.	ton	80-85	.....
Scraps and splits.	ton	85	.....
Silica brick, 9-in. sizes, f.o.b. Chicago district.	1,000	48-50	.....
Silica brick, 9-in. sizes, f.o.b. Birmingham district.	1,000	48-50	.....
F.o.b. Mt. Union, Pa.	1,000	42-44	.....
Silicon carbide refract. brick, 9-in.	1,000	1,100.00	.....

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y.	ton	\$200.00	\$225.00
Ferromanganese, per lb. of Cr. 6-8% C.	lb.	.11	.11
4-6% C.	lb.	.11	.12
Ferromanganese, 78-82% Mn, Atlantic seab. duty paid.	gr. ton	105.00	107.50
Spiegeleisen, 19-21% Mn.	gr. ton	35.00	37.00
Ferromolybdenum, 50-60% Mo, per lb. Mo.	lb.	1.90	2.15
Ferrosilicon, 10-15%.	gr. ton	38.00	40.00
50%.	gr. ton	80.00	85.00
75%.	gr. ton	150.00	165.00

Ferrotungsten, 70-80%, per lb. of W.	lb.	\$0.90	\$0.95
Ferro-uranium, 35-50% of U, per lb. of U.	lb.	6.00	.....
Ferrovanadium, 30-40%, per lb. of V.	lb.	3.50	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points.	ton	\$6.50	\$8.75
Chrome ore, Calif. concentrates, 50% min. Cr ₂ O ₃ .	ton	22.00	23.00
C.I.F. Atlantic seaboard.	ton	18.50	19.00
Coke, fdry., f.o.b. ovens.	ton	9.25	9.50
Coke, furnace, f.o.b. ovens.	ton	8.00	8.50
Fluorspar, gravel, f.o.b. mines, New Mexico.	ton	17.50	.....
Fluorspar, No. 2 Lump—Ky. & Ill. mines.	ton	25.00	.....
Ilmenite, 52% TiO ₂ .	lb.	.011	.01
Manganese ore, 50% Mn, c.i.f. Atlantic seaboard.	unit	.30	.....
Manganese ore, chemical (MnO ₂).	ton	75.00	80.00
Molybdenite, 85% MoS ₂ , per lb. MoS ₂ , N. Y.	lb.	.70	.75
Monazite, per unit of ThO ₂ , c.i.f. Atl. seaboard.	lb.	.06	.08
Pyrites, Span., fines, c.i.f. Atl. seaboard.	unit	.11	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaboard.	unit	.11	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	Nominal	.....
Rutile, 95% TiO ₂ .	lb.	.12	.....
Tungsten, scheelite, 60% WO ₃ and over, per unit.	unit	8.00	8.50
Tungsten, wolframite, 60% WO ₃ and over, per unit.	unit	7.50	8.00
Uranium ore (carnotite) per lb. of U ₃ O ₈ .	lb.	3.50	3.75
Uranium oxide, 96% per lb. U ₃ O ₈ .	lb.	2.25	2.50
Vanadium pentoxide, 99%.	lb.	12.00	14.00
Vanadium ore, per lb. V ₂ O ₅ .	lb.	1.00	.....
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	.041	.13

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic.	14.75
Aluminum, 98 to 99%.	23.00
Antimony, wholesale, Chinese and Japanese.	6.85-7.00
Nickel, ordinary (ingot).	28-30
Nickel, electrolytic.	29-30
Nickel, electrolytic, resale.	25-27
Nickel, ingot and shot, resale.	36.00
Monel metal, shot and blocks.	32.00
Monel metal, ingots.	35.00
Monel metal, sheet bars.	38.00
Tin, 5-ton lots, Straits.	40.00
Lead, New York, spot.	8.00
Lead, E. St. Louis, spot.	7.90-8.00
Zinc, spot, New York.	7.00
Zinc, spot, E. St. Louis.	6.65

OTHER METALS

Silver (commercial).	os.	\$0.67
Cadmium.	lb.	1.15
Bismuth (500 lb. lots).	lb.	2.50
Cobalt.	lb.	3.00@3.25
Magnesium, ingots, 99%.	lb.	1.00@1.05
Platinum.	os.	110.00
Iridium.	os.	250.00@275.00
Palladium.	os.	65.00@70.00
Mercury.	75 lb.	72.50

FINISHED METAL PRODUCTS

	Warehouse Price	Cents per Lb.
Copper sheets, hot rolled.	20.75
Copper bottoms.	30.75
Copper rods.	20.50
High brass wire.	19.50
High brass rods.	17.00
Low brass wire.	21.10
Low brass rods.	22.00
Brass tubing.	24.25
Brass bronze tubing.	29.00
Seamless copper tubing.	25.25
Seamless high brass tubing.	23.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible.	11.30@11.50
Copper, heavy and wire.	11.25@11.50
Copper, light and bottoms.	9.25@9.50
Lead, heavy.	5.75@6.00
Lead, tea.	3.50@3.75
Brass, heavy.	6.25@6.40
Brass, light.	5.35@5.75
No. 1 yellow brass turnings.	6.30@6.50
Zinc.	3.50@4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by 1/2 in. and larger, and plates 1/2 in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes.	\$3.14	\$3.14
Soft steel bars.	3.04	3.04
Soft steel bar shapes.	3.04	3.04
Soft steel bands.	3.84	3.84
Plates, 1/2 to 1 in. thick.	3.14	3.14

Industrial

Financial, Construction and Manufacturers' News

Construction and Operation

Alabama

MOBILE—The Great Southern Roofing Co., recently organized with a capital of \$125,000, has leased a local building for the establishment of a new plant for the manufacture of composition roofing specialties. A power house and new tank storage building will be constructed. T. J. Larkin is president.

SHEFFIELD—Samuel W. Kendall, Meridian, Miss., is completing the organization of a company to construct and operate a cement-manufacturing plant in this section. The Kelley quarry property, near the government's nitrate plant No. 2, has been acquired and work will soon be commenced on the initial units, with total capacity of about 2,000 bbl. per day. It is also proposed to install a limekiln, which will be ready for service at an early date. The cement plant unit will be completed early in July. The works are estimated to cost close to \$100,000, including machinery.

Arkansas

EL DORADO—The Evans-Thwing Refining Co., 624 Finance Bldg., Kansas City, Mo., is completing plans and will soon commence the construction of a new oil refinery on site selected at El Dorado, estimated to cost about \$500,000, including machinery. The general contract for the structural work has been awarded to the George H. Siedhoff Construction Co., Wichita, Kan.

California

LOS ANGELES—The California Flax Seed Products Co. has awarded a contract to the Austin Co., Pacific Electric Bldg., for the erection of a new 1-story plant, 75x100 ft., on 26th St., near Santa Fe Ave., estimated to cost approximately \$18,000.

OAKLAND—The California Salt Co., Mills Bldg., San Francisco, has tentative plans under consideration for the rebuilding of the portion of its plant on San Francisco Bay, near Oakland, destroyed by fire, Jan. 14, with loss approximating \$300,000, including equipment.

WALNUT CREEK—The Pacific Cellulose Co. will establish a chemical plant in connection with its proposed new local mills for the manufacture of artificial silk. The former works of the Diablo Glove Co. has been secured, with a 6-acre tract of land for the erection of additional buildings. Dr. C. A. Schwartz is vice-president, and E. A. Schwartz secretary and treasurer.

SAN FRANCISCO—The Standard Oil Co., 200 Bush St., is planning for the construction of a new storage and distributing plant on the North Beach, foot of Jones St., with initial capacity of 30,000 bbl.

Connecticut

WATERBURY—The American Brass Co. has awarded a contract to the Tracy Brothers Co., Waterbury, for the erection of a new 3-story building at its plant, 80x100 ft.

Georgia

ATLANTA—The Union Seed & Oil Co., Mason Ave., has plans under way for the rebuilding of the portion of its plant, destroyed by fire, Jan. 14, with loss of about \$15,000.

Idaho

CORVALLIS—The Independence Lead Mines, Ltd., is considering plans for the erection of a new mill at its properties, with initial capacity of about 100 tons per day. R. M. Atwater, Jr., is company engineer in charge. Harry B. Kingsbury is president.

Illinois

STERLING—The Black Silk Stove Polish Co. is completing plans and will soon take bids for the erection of a new plant, 3-story, 128x130 ft., estimated to cost approximately

\$80,000. Ashby, Ashby & Schulze, West Jackson Blvd., Chicago, are architects. L. K. Wynn is president.

CHICAGO—Bauer & Black, 2500 South Dearborn St., chemists and drug manufacturers, have purchased property on 26th St., between Dearborn and Federal Sts., for a total consideration of \$110,000, and will use the site for extensions in their plant. The proposed factory will approximate 100x400 ft.

CHICAGO—The Chicago Fiber Box Co., recently organized, has leased space in the building at 833 Rees St. for a term of years, for the establishment of a new plant.

Indiana

SEYMOUR—The Silverstone Stucco & Plaster Products Co., 220 Indiana Pythian Bldg., Indianapolis, recently organized, has commissioned Merritt, Harrison & Turnock, 500 Board of Trade Bldg., Indianapolis, to prepare plans for its proposed new plant to be erected at Seymour, for the manufacture of stucco and plaster products. The main structure will be 1-story, 50x96 ft. John R. Briggs is president.

Iowa

WATERLOO—The Rath Packing Co., Sycamore and Elm Sts., has revised plans in preparation for the erection of a new building at its plant for the manufacture of fertilizer products. Henschien & McLaren, 1637 Prairie Ave., Chicago, Ill., are architects. J. W. Rath is president.

MADISON—The Hinde & Dauch Paper Co., Sandusky, O., contemplates the erection of a new mill at the foot of Occidental St., for the manufacture of paperboard products.

Kansas

WICHITA—The Western Glass Co., 531 North Market St., has plans in preparation for the erection of a new 2-story and basement building, 75x100 ft., on North Market St., to cost about \$35,000. Edward Forsbloom, Sedgwick Bldg., is architect.

Kentucky

LEXINGTON—The Red Top Coal Co., recently organized, is planning for the establishment of a new local plant for the manufacture of smokeless powder to be used for blasting service in connection with its coal-mining operations.

OWENSBURG—Bolger & Medley are considering plans for the erection of a new local plant for the manufacture of brick and tile products.

Louisiana

BOGALUSA—The Bogalusa Paper Co. has plans in progress for the erection of an addition to its plant, to include 5 new buildings, with machine department, 55x300 ft.; finishing department, 150x150 ft.; beater department, 96x140 ft.; general mill, 60x80 ft.; and generator building, 95x140 ft. The structures will be used for the manufacture of kraft papers, increasing the output from 90 to 135 tons per day. The plant, exclusive of machinery, will cost about \$350,000, with equipment installation estimated to cost about \$600,000 additional. James L. Carey, 208 North Laramie Ave., Chicago, Ill., is engineer.

MONROE—The Gulf Carbon Co., Baltimore, Md., recently organized under Maryland laws with a capital of \$250,000, has plans under way for the erection of a new plant at Monroe, where a site of about 3 acres of land has been purchased. It is proposed to provide equipment for a daily output of about 8,000 lb. The plant is estimated to cost close to \$200,000, with machinery. William A. Gillespie, Union Trust Bldg., Baltimore, is secretary and treasurer.

Maryland

LAUREL—The Lapsey & Brothers Co., 30 South Hanover St., Baltimore, will install a special mechanical drying department at its proposed new plant at Laurel, for treating and drying of painted shade cloth. A mechanical painting works will also be provided.

The complete equipment installation is estimated to cost about \$100,000.

BALTIMORE—The Continental Roofing & Mfg. Co., recently organized, has acquired the factory of the McHenry-Millhouse Mfg. Co., for the establishment of a new plant for the manufacture of coal-tar and composition roofing products. Thomas M. Riengard heads the company.

Massachusetts

WATERTOWN—The Hood Rubber Co., Nichols Ave., manufacturer of tires and other rubber products, has awarded a contract to the Aberthaw Construction Co., 27 School St., Boston, for the erection of a 3-story addition to its plant, totaling about 9,600 sq. ft. in area. F. C. Hood is general manager.

HOLYOKE—The Chemical Paper Mfg. Co. has acquired the local mill of the United States Envelope Co., and will use the property for extensions in its present works on Jackson St. The United States company will remove the machinery now at the factory to its plants in other cities.

Michigan

DETROIT—The Codge Brass & Aluminum Mfg. Co., care of Robert Finn, 622 McKerchey Bldg., has awarded a contract to Alfred R. Yops, 3072 Maybury Ave., for the erection of a new 1-story foundry, 50x140 ft., estimated to cost about \$15,000.

SAGINAW—The United States Graphite Co. has preliminary plans in progress for the erection of a new 1-story plant on Holland St. Cowles & Mutscheller, Chase Bldg., are architects. Harry C. Woodruff is vice-president.

PLYMOUTH—The Lee Foundry & Machine Co., 420 Mill St., manufacturer of iron and steel castings, has commissioned Christian W. Brandt, 1114 Kregge Bldg., Detroit, architect, to prepare plans for a 1-story foundry addition, to cost \$30,000.

Minnesota

ST. CHARLES—The Minnesota Gold Mining Co. will take bids early in February for the erection of a new 1-story ore reduction plant at Elba, near St. Charles, to cost about \$125,000, including machinery. A. Miles Bean, Denver, Colo., is engineer. E. M. Gainey is secretary.

Missouri

KANSAS CITY—The Kansas City Gas Co., a subsidiary of the United Gas Improvement Co., Broad and Arch Sts., Philadelphia, Pa., is considering the erection of a new 1- and 2-story addition to its artificial gas plant.

New Jersey

TRENTON—The Trenton Potteries Co., North Clinton St., manufacturer of sanitary ware, has commenced the erection of a new addition at the plant of its Equitable Pottery, Lalor and Hancock Sts., to cost approximately \$100,000. It will consist of a pressing shop, drying department, and kiln room, 70x110 ft. William A. Klemann, 1st National Bank Bldg., is architect.

New York

LAUREL HILL—The Nichols Copper Co., 25 Broad St., New York, has filed plans for the immediate construction of a 3-story addition to its plant at Laurel Hill, L. I., 41x57 ft., estimated to cost about \$25,000.

ROCHESTER—The Dominion Feldspar Corp., has completed plans and will commence the erection of a new grinding mill, 63x104 ft., at its plant at the Genesee Dock, foot of Boxart St.

North Carolina

CHARLOTTE—The J. B. Davis Concrete Products Co., 901 Davidson St., is planning for the construction of a new plant, 50x150 ft., for the manufacture of septic tanks and other concrete products. The equipment installation will comprise mixers, molds and kindred apparatus. J. B. Davis is president.

Ohio

AKRON—The National Sulphur Co., 80 Maiden Lane, New York, has plans in progress for the erection of an addition to its new plant at North Akron, soon to be placed in operation. It will cost about \$75,000, including equipment. The company is removing its former works at Bayonne, N. J., to the new location.

ASHLAND—The Faultless Rubber Co. has awarded a contract to the Camp Construction Co., 520 Newman Stern Bldg., Cleveland, for the erection of a 1- and 2-story

addition to its plant, to be used for general rubber and acid service, 46x135 ft. The Osborn Engineering Co., 2848 Prospect Ave., South, Cleveland, is engineer.

Oklahoma

HOCKERVILLE—The St. Louis Smelting & Refining Co. has work in progress on 2 new concentration plants, one to be located near the Ontario lead smelter and the other on the H. E. Ambo property. The mills are estimated to cost in excess of \$175,000.

TULSA—The Peer Oil Corp. is being organized with a capital of \$5,000,000 and 1,000,000 shares of common stock, no par value, to take over and merge the Kansas & Gulf Co., 332 South Michigan Ave., Chicago, Ill., the Monarch Oil & Refining Co., and the Southern Petroleum Co. The new corporation will operate properties and refineries in Oklahoma, Arkansas, Kansas, Louisiana and Texas, and plans for extensive increase in production. The present gasoline plants have a rated capacity of 10,000 gal. per day.

WYNEWOOD—The Texas-Pacific Coal & Oil Co., Fort Worth, Tex., will commence the immediate erection of a new oil-refining plant on local site, estimated to cost close to \$1,000,000, including machinery.

MIAMI—The Chanute Smelter Co., Joplin, Mo., is said to have closed negotiations for an extensive tract of local lead and zinc properties, totalling about 5,000 acres. Development will be commenced at an early date. A plant is projected.

Oregon

HUNTINGTON—The Columbia Cement Co., Concord Bldg., Portland, has plans nearing completion for the erection of a new cement-manufacturing plant on local site, estimated to cost in excess of \$500,000, including machinery. The company is operating with a capital of \$2,000,000.

Pennsylvania

HELLAM—A. J. Hershey, Hartman Bldg., York, Pa., is having plans prepared for the construction of a new 1-story clay reduction plant on site near Hellam, to be 30x60 ft., estimated to cost about \$20,000. John Crowe, Hartman Bldg., York, is architect.

PHILADELPHIA—The Garrett-Buchanan Co., 13 South 6th St., manufacturer of paper products, has filed plans for the erection of a new building at its plant to cost about \$55,000.

MIDLAND—The Crucible Steel Co. of America, Oliver Bldg., Pittsburgh, is completing plans for the erection of a new 1-story liquid purification plant at its Midland works, estimated to cost \$60,000. The Koppers Co., Union Arcade, Pittsburgh, is engineer.

READING—The Philadelphia & Reading Railroad Co., Reading Terminal, Philadelphia, has commenced the erection of a new oil storage and distributing plant at Reading, with capacity of about 200,000 gal. It will be 75x150 ft., and is expected to be ready for the equipment installation early in the spring.

South Carolina

MANNING—The Manning Oil Mill has been acquired by F. D. Hunter and associates. The new owners plan extensions.

Texas

ROCKDALE—The Austin Petroleum Co., Inc., Austin, will soon commence the installation of additional equipment at its local oil refinery for general increase in production. W. H. McClanahan is secretary and manager.

BEAUMONT—The Atlantic Refining Co., 3144 Passyunk Ave., Philadelphia, Pa., has acquired a tract of land of about 500 acres on the Neches River, and plans to use the site for a new oil-refining plant.

HARLINGEN—The Rio Grande Tire & Rubber Co. has commenced the erection of a new local plant for the manufacture of automobile tires and other rubber products. It is estimated to cost close to \$50,000.

STAMFORD—The Chickasha Cotton Oil Co., Chickasha, Okla., has preliminary plans under way for the erection of a new oil mill at Stamford, to cost approximately \$150,000, including machinery.

TEXAS CITY—The Pierce Oil Co., is planning for extensions in its local plant to cost close to \$20,000. A. W. Grant is superintendent.

BRECKENRIDGE—The Central Gasoline Producing Co. is planning for the immediate rebuilding of the portion of its local refining plant recently destroyed by fire with loss of about \$32,000.

Industrial Developments

PAPER—The International Paper Co., New York, has increased production at its different mills to a normal basis, with a schedule of close to 1,900 tons output per day, or at the annual rate of 580,000 tons of newsprint. During 1922 the total production was 422,809 tons. The company has advanced the wages of skilled employees at the mills, averaging about 30 per cent of the total working forces, from 6 to 7 per cent over the previous wage level. About 900 operatives are affected.

The paper mills at Holyoke, Mass., giving employment to from 5,500 to 6,000 workers, have advanced the wage scale from 5 to 8 cents an hour, depending upon occupation. The increase became effective Jan. 15.

The Uncas Paperboard Co., Norwich, Conn., recently organized, has commenced operations in a remodeled portion of its new local mill, formerly the plant of the Ironsides Board Corp., idle for about 15 years past. Additional improvements will be made at the mill.

CERAMIC—The International Brick Co., El Paso, Tex., is advancing production at its plant and is now running on a basis of 80,000 brick and tile per day, as compared with a previous output of 70,000 daily. The working force has been materially increased. A large part of the output is for Arizona work.

The Crescent China Co., Niles, O., is completing the erection of a new plant at Alliance, O., and plans for early operations.

The P. Bannon Pipe Co., Louisville, Ky., is maintaining regular operations at its plant, with normal working force, and is said to have orders on hand to insure production on this schedule for some time to come.

The Acme Brick Co., Denton, Tex., has resumed production at its plant and plans to develop capacity at an early date. Additional machinery will be installed to provide for a maximum output of about 60,000 bricks per day. A. B. Kelley is general manager.

Kiln placers in the potteries in the East Liverpool, O., district, including plants at East Liverpool, O., and Wellsville, O., and at Chester and Newell, W. Va., recently out on strike, have returned to their work. The men were recently granted a wage advance of 7 per cent, and have now asked that pottery companies defray one-half the wages of the "pin boy," who is a member of each pottery crew, and paid by the kiln placers. The request has been refused.

The Vallejo Brick Co., Vallejo, Calif., is operating at capacity at its plant, and has plans under way for extensive additions for increased output. It is proposed to create a fund of about \$100,000 for the expansion.

Workers in the sanitary ware branch of the pottery industry at Trenton, N. J., are still out on strike, although the plants are filling the positions with other men. About 5,000 men and women are now said to be idle.

The Glenwood Shale Brick Co., Erie, Pa., is maintaining capacity production at its plant, and expects to continue on this basis throughout the winter season.

RUBBER—The Fiske Rubber Co., Chicopee Falls, Mass., is advancing production at its different plants, and practically capacity output is now operative. The works, in addition to the local mill, include the factories at Springfield, Mass., Pawtucket, R. I., and Milwaukee, Wis., with present daily output of 24,500 casings and 32,500 tubes.

The Dunlop Tire & Rubber Co., River Rd., Buffalo, N. Y., is making ready for initial production at its local mill and will make an expenditure of approximately \$750,000 for the installation of necessary equipment and improvements in present machinery. It is expected to give employment to a working force of about 5,000 persons, and to advance this at the rate of 150 employees a month for a number of months to come. It is expected to develop an output of 2,500 tires per day. Edwin B. Germain is president.

The Miller Rubber Co., Akron, O., manufacturer of automobile tires, has opened a new plant, recently completed, to be used for the manufacture of rubber gloves. The company is resuming this line of production after a discontinuance since 1920.

The Goodyear Tire & Rubber Co., Akron, O., has refused the demand of employees at the plant for a wage advance of 15 per cent. The company has increased the wage scale 7½ per cent since last July.

IRON AND STEEL—The Colorado Fuel & Iron Co., Denver, Colo., with mills at Pueblo, Colo., is arranging to blow in 4

additional furnaces at its plant in the Silver City, N. M., district at an early date.

The Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., a subsidiary of the United States Steel Corp., is breaking all previous production records for pig iron at its furnaces. During December a total of 81,000 tons was produced.

The Youngstown Sheet & Tube Co., Youngstown, O., is planning to blow in an additional blast furnace at its plant at an early date. The company has recently resumed at a number of sheet mills.

The present steel mill capacity in the Niles, O., district, is now about 88 per cent of normal. A total of 45 of the 51 mills are in active production.

The N. & G. Taylor Co., Cumberland, Md., manufacturer of tin and terne plate, is maintaining regular production at its local mills, with close to normal working force.

The Gulf States Steel Co., Birmingham, Ala., is developing maximum production, with its ingot mill at capacity and finishing mills now on double turn.

The Reading Iron Co., Reading, Pa., has recently advanced the wages of puddlers at its mills to \$9.80 a ton, as compared with a previous scale of \$8.80 a ton. A proportionate advance has also been made in the tonnage rates of other material. Common labor has been increased from 30 to 33 cents an hour. A total of 6,000 men are affected by the change, which became operative Jan. 15.

MISCELLANEOUS—The Great Texas Oil & Refining Co., Breckenridge, Tex., is planning for the early operation of its new oil refinery on local site, now nearing completion. The plant will have a capacity for handling 5,000 bbl. of crude oil per day, with refining facilities for producing 500 bbl. of lubricating oils and other petroleum byproducts daily. It will represent an investment of close to \$1,000,000.

The Electric Hose & Rubber Co., Wilmington, Del., manufacturer of heavy rubber hose for air brake and other service, has adopted a night shift at its plant, in addition to regular day operations. The company is said to have orders on hand to insure this basis of output for about 6 months to come.

The Hudsonale Ochre Works, Hudsonale, Pa., is increasing production at its plant, and has recently added a night shift in addition to the regular day force.

The National Enameling & Stamping Co., New York, is operating its metal plants in the Baltimore, Md., district at practically full capacity, and will continue on this schedule for an indefinite period.

The Lancaster Foundry Co., Lancaster, Pa., manufacturer of iron and steel castings, has resumed production at its plant after a shut down since early last July. Employment will be given to about 75 operatives.

Capital Increases, etc.

THE DIAMOND CRYSTAL SALT Co., St. Clair, Mich., has filed notice of increase in capital from \$1,500,000 to \$2,050,000.

THE SUPERIOR GUANO Co., 4th Ave. and Clinton St., Baltimore, Md., manufacturer of fertilizer products, has arranged for an increase in capital from \$100,000 to \$250,000.

THE SOUTHWESTERN COTTON OIL Co., Oklahoma City, Okla., has arranged for an increase in capital from \$100,000 to \$500,000, for proposed expansion.

THE HEGLER ZINC Co., Danville, Ill., has filed notice of increase in capital from \$380,000 to \$2,000,000, for expansion.

THE AMERICAN GLUE Co., 121 Beverly St., Boston, Mass., is disposing of a note issue of \$2,500,000, a portion of the proceeds to be used for expansion and additions to working capital.

THE BUCK GLASS Co., Fort Ave. and Orange St., Baltimore, Md., has arranged for an increase in capital from \$150,000 to \$250,000.

THE AMERICAN HARD RUBBER Co., 11 Mercer St., New York, N. Y., has filed notice of increase in capital from \$5,000,000 to \$7,500,000.

THE CLIFFERT BRICK Co., Springwells, Mich., has increased its capital from \$100,000 to \$700,000, for general expansion.

THE HAMMERMILL PAPER Co., Erie, Pa., is disposing of a preferred stock issue of \$3,000,000, a portion of the proceeds to be used for additional working capital.

THE LEHIGH PORTLAND CEMENT Co., Allentown, Pa., has arranged for an increase in capital from \$18,000,000 to \$25,000,000.

New Publications

PAMPHLETS, ETC.

THE BUSINESS LAW JOURNAL is the title of a new monthly publication, which will contain the current important commercial decisions of the state and federal courts. Each issue will present 50 to 60 such decisions. Each decision will be set forth at sufficient length to explain the facts, the question presented, the court's conclusion, and the reasoning upon which the same is based. The following is a partial list of the subjects under which the decisions will group themselves: Corporations, insurance, sales, contracts, railroads, banking, negotiable paper, mortgages, bankruptcy, brokers, taxation, mining, workmen's compensation, and the decisions of the Federal Trade Commission dealing with unfair competition. Each issue will also contain articles dealing with practical problems of commercial law and recent legislation affecting business. The magazine is intended for the use of business men, manufacturers, bankers, accountants, credit men, etc. Its object is to keep them in touch with the current business decisions, especially those in which a loss has been unnecessarily sustained. The editor will be John Edison Brady, who since 1910 has been editor of the *Banking Law Journal*. The magazine is published by the Business Law Journal Co., 71 Murray St., New York City. The subscription price is \$8 per year.

THE UNITED STATES PUBLIC HEALTH SERVICE, Treasury Department, has issued Reprint 745 on "Physiological Effects of Exposure to Low Concentrations of Carbon Monoxide," by R. R. Sayers, F. V. Meriwether and W. P. Yant; Reprint 770, "Dermatosis Following the Use of Cutting Oils and Lubricating Compounds," by William J. McConnell, and Reprint 786, on "The Effect of Gasoline Fumes on Dispensary Attendance and Output in a Group of Workers," by Octavius M. Spencer.

THE DOMINION BUREAU OF STATISTICS, Ottawa, Canada, has issued a booklet on "Chemical and Allied Products—1919 and 1920" and "Coal Statistics for Canada" for the calendar years 1919, 1920 and 1921.

THE DIVISION OF ENGINEERING of the National Research Council has just issued a booklet giving much information about its organization, work and personnel. The National Research Council is a co-operative organization of American societies and scientific men concerned with the physical, mathematical and biological sciences, and the applications to human welfare through the agricultural, engineering and medical arts. Approximately eighty societies are included. The main offices of the Council are at 1701 Massachusetts Ave., Washington, D. C., pending the completion of its permanent building near the Lincoln Memorial. The Division of Engineering has offices in the Engineering Societies Building, 29 West 39th St., New York, to facilitate co-operation with the engineering societies and the Engineering Foundation.

NEW U. S. GEOLOGICAL SURVEY PUBLICATIONS: I: 16, Secondary Metals in 1921, by J. P. Dunlop (Mineral Resources of the U. S., 1921, Part 1), published Oct. 12, 1922; I: 17, Gold Silver, Copper, Lead and Zinc in California and Oregon in 1921, by Charles G. Yale (Mineral Resources of the U. S., 1921, Part 1), published Oct. 23, 1922; I: 20, Gold, Silver, Copper, Lead and Zinc in Montana in 1921, by C. N. Gerry (Mineral Resources of the U. S., 1921, Part 1), published Nov. 17, 1922; II: 34, Coke and Byproducts in 1919-1920, by R. S. McBride and F. G. Tyron (Mineral Resources of the U. S., 1920, Part 11), published Oct. 18, 1922; II: 35, Manufactured Gas and Byproducts in 1920, by R. S. McBride (Mineral Resources of the U. S., 1920, Part II), published Dec. 12, 1922.

NEW BUREAU OF STANDARDS PUBLICATIONS: Circ. 24, Publications of the Bureau of Standards; Circ. 86, U. S. Govt. Specification for Turpentine; Circ. 102, Specification of Composite Vehicle for Thinning Semipaste Paints When the Use of Straight Linseed Oil Is Not Justified; Circ. 134, Specification for Fire-Extinguishing Liquid (Carbon Tetrachloride Base); Circ. 135, Caustic Magnesia Cement; Scien. Paper 444, Practical Spectrographic Analysis, by W. F. Meggers, C. C. Kless and F. J. Stimson; Scien. Paper 448, Decarburization of Ferrochromium by Hydrogen, by Louis Jordan and F. E. Swindells; Scien. Paper 452, Structure of Martensitic Carbon Steels and Changes in Microstructure Which Occur Upon Tempering, by Henry S. Rawdon and Samuel Epstein; Scien. Paper 453, Preparation and Properties of Pure Iron Alloys, by Robert P. Neville and John R. Cain; Scien. Paper 457, Gases in Metals: 1. The Determination of Combined Nitrogen in Iron and Steel and the Change

in Form of Nitrogen by Heat-Treatment, by Louis Jordan and F. E. Swindells; Tech. Paper 218, Results of Some Compression Tests of Structural Steel Angles, by A. H. Stang and L. R. Strickenberg; Tech. Paper 219, Effect of Temperature, Deformation and Rate of Loading on the Tensile Properties of Low-Carbon Steel Below the Thermal Critical Range, by H. J. French; Tech. Paper 222, Relative Usefulness of Gases of Different Heating Value and Adjustments of Burners for Changes in Heating Value and Specific Gravity, by Walter M. Berry, I. V. Brumbaugh, J. H. Elseman, G. F. Moulton and G. B. Shawn; Tech. Paper 223, Reclamation of Used Petroleum Lubricating Oils, by Winslow H. Herschel and A. H. Anderson.

Industrial Notes

THE HAZARD ADVERTISING CORP., 7 East 42nd St., New York City, announces that H. Gardner McKerrrow, formerly advertising manager of the National Aniline & Chemical Co., has recently joined the organization. Mr. McKerrrow's long experience in the textile and chemical industries has given him an understanding of processes and methods that will enable the Hazard agency, which specializes on technical accounts, to extend its service for technical clients.

F. J. Low recently resigned as vice-president of the agency with which he was associated for more than 6 years and has organized an advertising agency under the name of F. J. Low Co., Inc., with offices at 15 West 44th St., New York City. Mr. Low was for many years advertising manager of H. W. Johns-Manville Co. and has also been associated with the advertising of the Chicago Fuse Mfg. Co., American Steam Gauge & Valve Mfg. Co., the Schaeffer & Budenberg Corp., Sarco Co., Inc., and other concerns in the technical field.

STEWART-THRILL Co. is the new name of the Walter L. Flower Co. of St. Louis, district representative of the Conveyors Corp. of America, Chicago. The personnel of the organization remains the same and offices will be continued at 312 8th St., St. Louis.

The directors of GIFFORD-WOOD Co., Hudson, N. Y., at a recent meeting appointed Joseph A. Boucher to the position of sales manager.

THE AIR REDUCTION SALES CO., New York City, has consolidated its executive offices at 120 Broadway and 160 Fifth Ave., which will now be located at 342 Madison Ave., New York City.

E. M. RHOADS, president and treasurer of the Sanitary Co. of America, has disposed of his controlling interest in that company and resigned from the management on Jan. 5, 1923. A number of the former officers of the Sanitary Co. of America, together with factory superintendents, etc., are associated in the building of a soil pipe plant at Boyertown, Pa., to be known as the Eastern Foundry Co. The personnel of this latter company is as follows: E. M. Rhoads, president; B. W. Frederick, vice-president; Grant P. Bechtel, secretary and assistant treasurer; Daniel G. Burkert, assistant secretary and purchasing agent, and Harry R. Trout, general superintendent.

TOCH BROTHERS have moved their executive and sales offices to 110 East 42nd St., New York.

THE COMBUSTION ENGINEERING CORP., New York, announces the acquisition of the Quinn Oil Burner & Torch Co. W. R. Quinn, former president of the Quinn Oil Burner & Torch Co., has become associated with the Combustion Engineering Corp. as manager of its fuel oil department.

THE CHAIN BELT CO., Milwaukee, Wis., announces the appointment of Fitch S. Bosworth as manager of the Chicago office, effective Jan. 1, 1923. Mr. Bosworth has been in charge of the Chain Belt Co.'s St. Louis office for the last 3 years and has specialized on chain and conveying engineering problems. With him will be associated Raymond X. Raymond, who for several years has been connected with the export sales department in Milwaukee. Thomas F. Scannell, formerly of the Chicago office, has been placed in charge of the St. Louis office.

THE JERSEY CITY WELDING SHOP of the Metal & Thermit Corp., in addition to its present facilities for undertaking Thermit welding repairs, has also been recently equipped for making welds on lighter sections by means of the oxy-acetylene and electric processes. This service will be of particular value in cases where large production work is desired. Work can be called for and delivered by truck. This policy of equipping welding shops with the additional welding facilities, as described above, will later be extended to the other welding plants.

THE OXWELD ACETYLENE CO., Newark, N. J., announces that its Western department, formerly located at 1077 Mission St., San Francisco, has recently moved to larger quarters in the same block. Leo Romney is manager.

THE DODGE SALES & ENGINEERING CO., Mishawaka, Ind., which has for the past 8 years been operating as the selling subsidiary of the Dodge Manufacturing Co. and Dodge Steel Pulley Corporation, has now been consolidated with the parent company, Dodge Manufacturing Corp., which was organized and began business last July. The Dodge Manufacturing Corp. at that time took over the two long-established manufacturing concerns, Dodge Manufacturing Co., organized in 1880 and Dodge Steel Pulley Corp., organized in 1917 as the successor of the Oneida Steel Pulley Co., which began the manufacture of steel pulleys in 1900. Since July, 1922, the manufacture of Dodge, Oneida and Keystone power transmission appliances and Dodge heavy oil engines has been conducted by the Dodge Manufacturing Corp. The distribution of Dodge products, which has heretofore been done under the name of the Dodge Sales & Engineering Co., will hereafter be conducted by the sales department of the Dodge Manufacturing Corp., with Duncan J. Campbell, general sales manager, in charge, and John A. Beynon assistant general sales manager.

Coming Meetings and Events

AMERICAN ASSOCIATION OF ENGINEERS will hold its annual convention in Norfolk, Va., May 7 to 9.

AMERICAN CERAMIC SOCIETY will hold its annual meeting in Pittsburgh, Pa., Feb. 13 to 17, 1923.

AMERICAN CHEMICAL SOCIETY will hold its spring meeting April 3 to 7, 1923, at New Haven, Conn.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its spring meeting May 3, 4 and 5, 1923, at the Commodore Hotel, New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION will hold a meeting in Cleveland, O., April 28 to May 4.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS will hold its annual meeting in New York City during the week of Feb. 19, 1923.

AMERICAN SOCIETY FOR STEEL TREATING will hold its winter sectional meeting in the City Club, Chicago, Feb. 8 and 9, 1923.

AMERICAN SOCIETY FOR TESTING MATERIALS will hold its twenty-sixth annual meeting at the Chalfonte-Haddon Hall Hotel, Atlantic City, beginning Monday, June 25, 1923, and ending either Friday or Saturday of that week.

INTERNATIONAL CHAMBER OF COMMERCE will hold its second general meeting in Rome, Italy, March 19-26, 1923.

NATIONAL FOREIGN TRADE COUNCIL will hold its annual conference April 25, 26 and 27, 1923, in New Orleans, La.

NEW JERSEY CHEMICAL SOCIETY holds a meeting at Stetters Restaurant, 842 Broad St., Newark, N. J., the second Monday of every month.

SOCIETY OF INDUSTRIAL ENGINEERS, with headquarters in Chicago, will hold its spring convention in Cincinnati, April 18, 19 and 20, 1923. The major subject will be "Management Problems of the Smaller Plants."

A PAPER INDUSTRIES EXPOSITION will be held in Grand Central Palace, New York City, during the week of April 9, 1923, by the International Exposition Co.

The following meetings are scheduled to be held in Rumford Hall, Chemists' Club, East 41st St., New York City: Feb. 9—American Electrochemical Society (in charge), Society of Chemical Industry, Société de Chimie Industrielle, American Chemical Society, joint meeting. March 9—American Chemical Society, Nichols Medal. March 23—Society of Chemical Industry, regular meeting. April 20—Society of Chemical Industry (in charge), American Electrochemical Society, Société de Chimie Industrielle, American Chemical Society, joint meeting. May 4—American Chemical Society, regular meeting. May 11—Société de Chimie Industrielle (in charge), American Chemical Society, American Electrochemical Society, Society of Chemical Industry, joint meeting. May 18—Society of Chemical Industry, regular meeting. June 8—American Chemical Society, regular meeting.